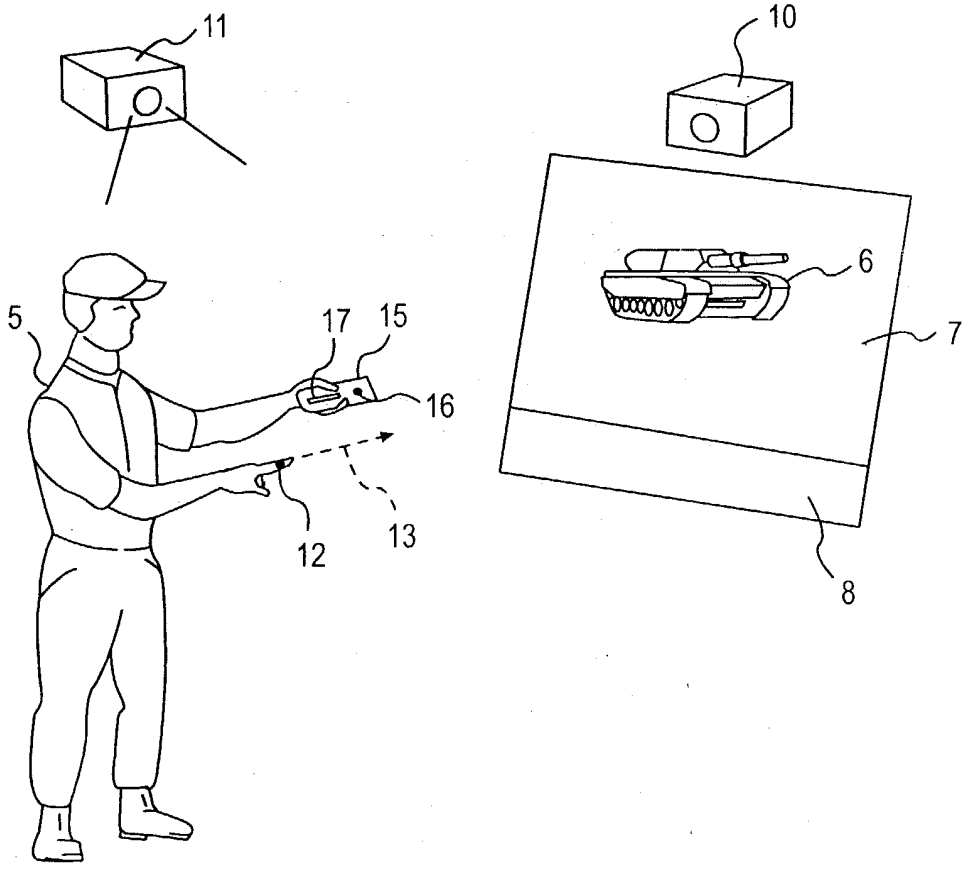

FIG. 1a

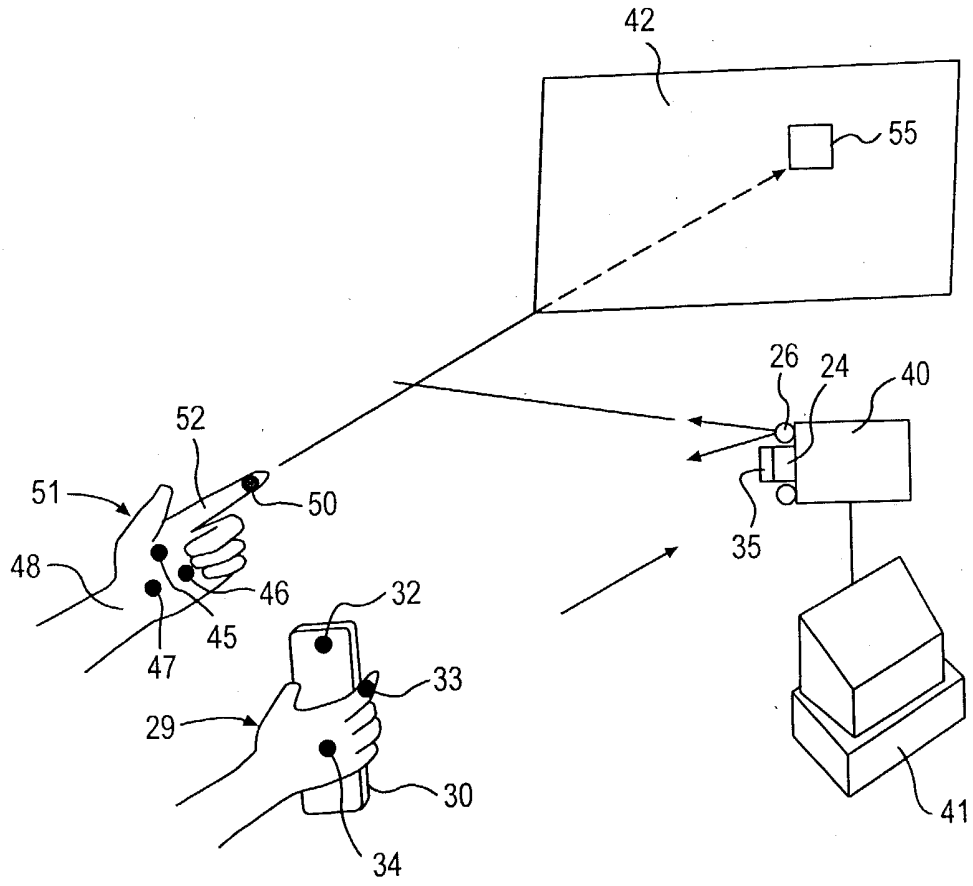

FIG. 1b

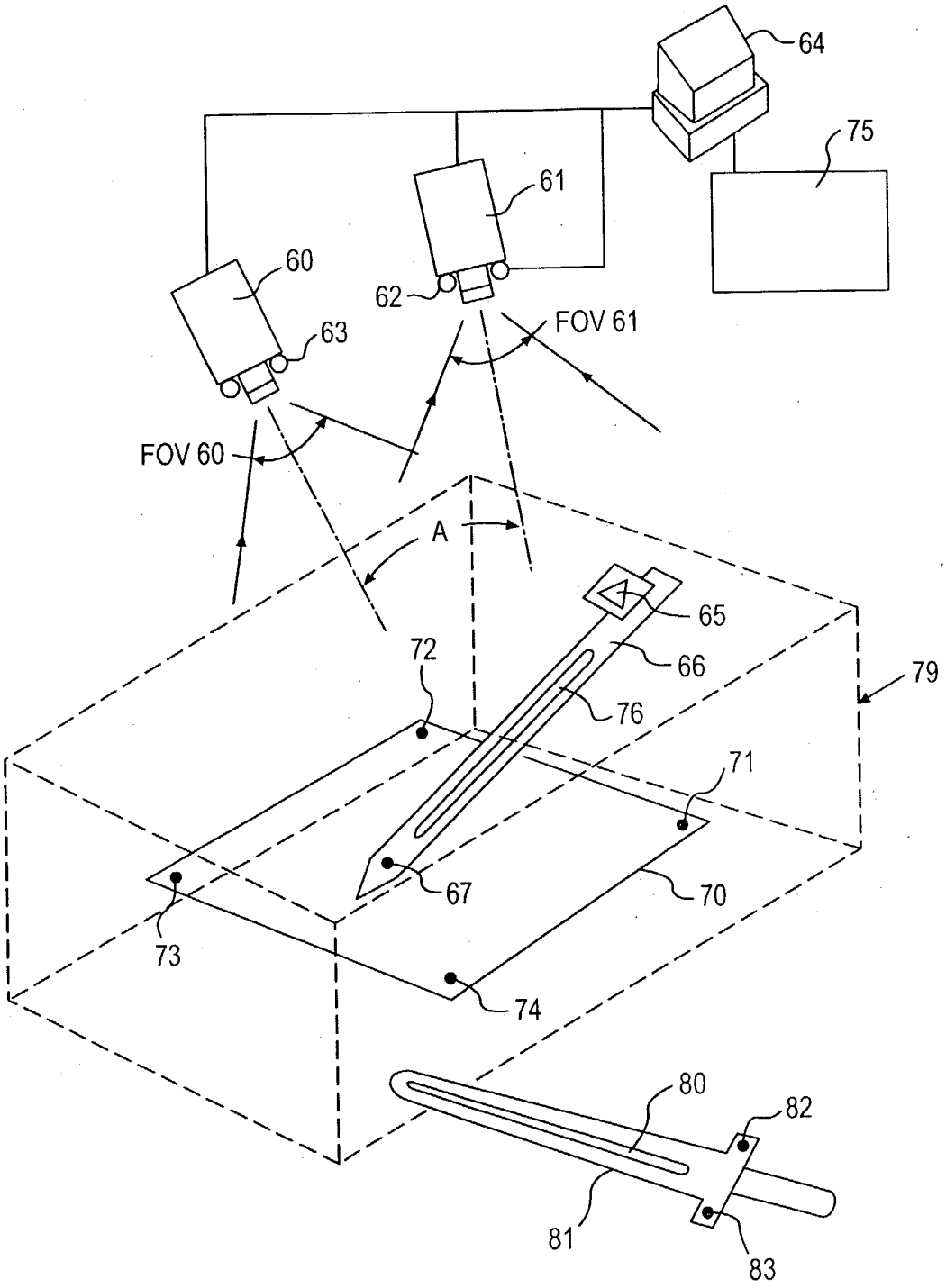
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FIG. 1c

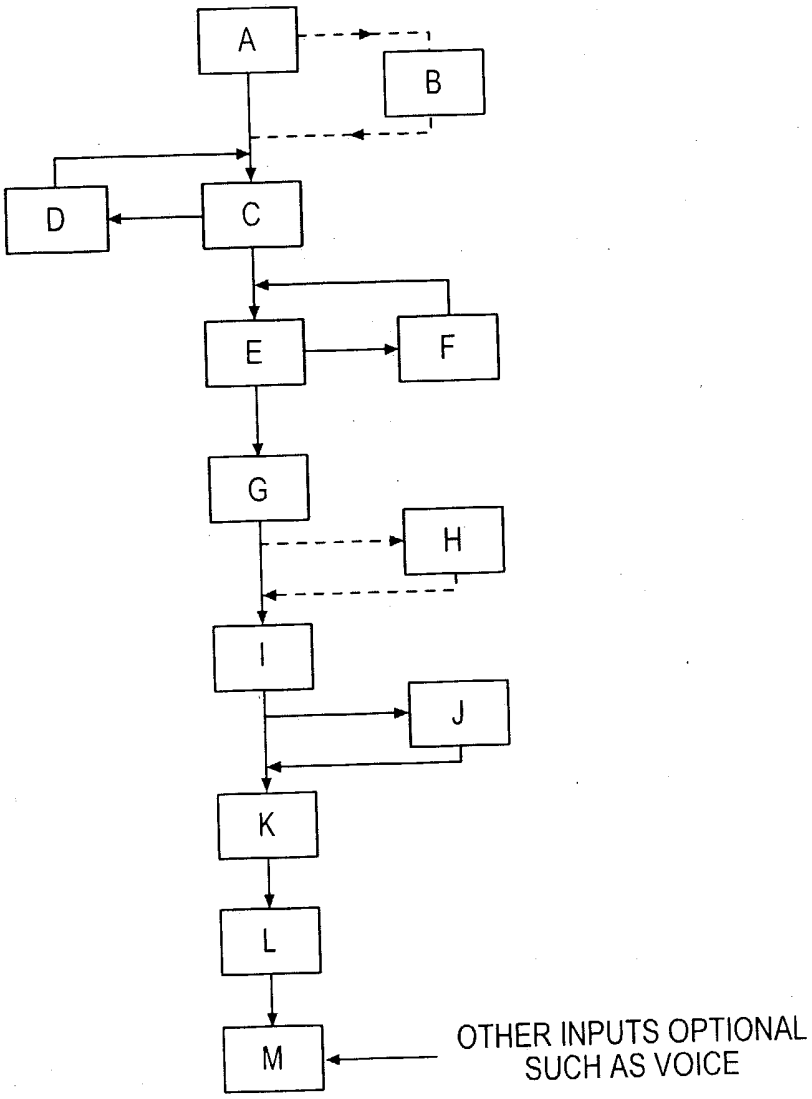

FIG. 1d

MAPPING ONE RGB COMPONENT OF A COLOR
HERE, THE RED COMPONENT IS USED. THE SAME PROCESS CAN BE USED FOR THE GREEN AND BLUE COMPONENTS AS WELL.

Ar - IS THE RED COMPONENT OF THE AQUA COLOR

Or - IS THE RED COMPONENT OF THE ORANGE COLOR

Pr - IS THE RED COMPONENT OF THE PIXEL COLOR

Cr - IS THE RED COMPONENT OF THE COLOR ADJUSTED TO BE BETWEEN A AND O

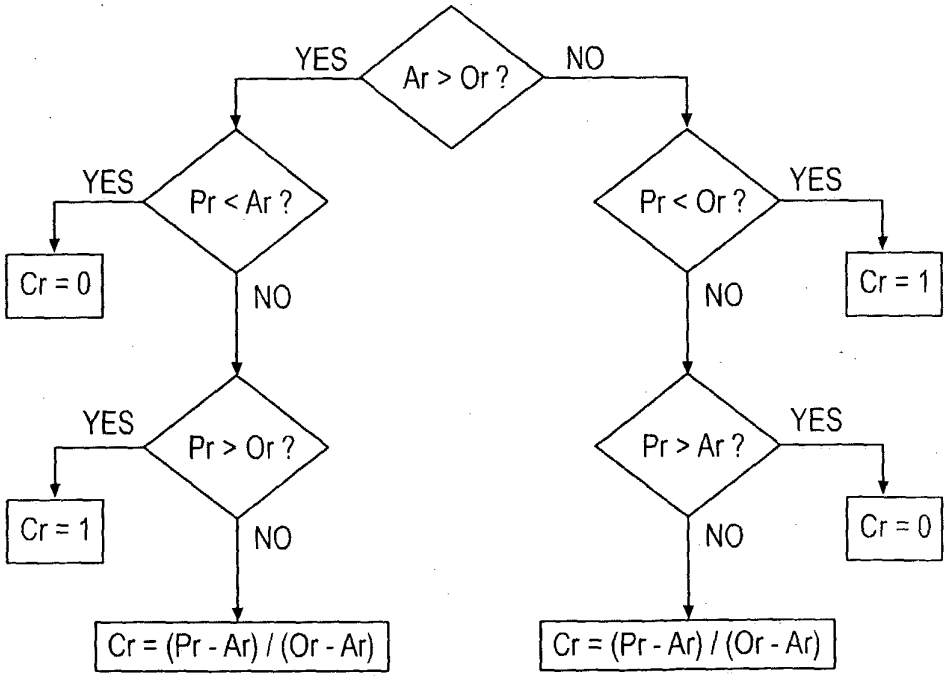

FIG. 1e

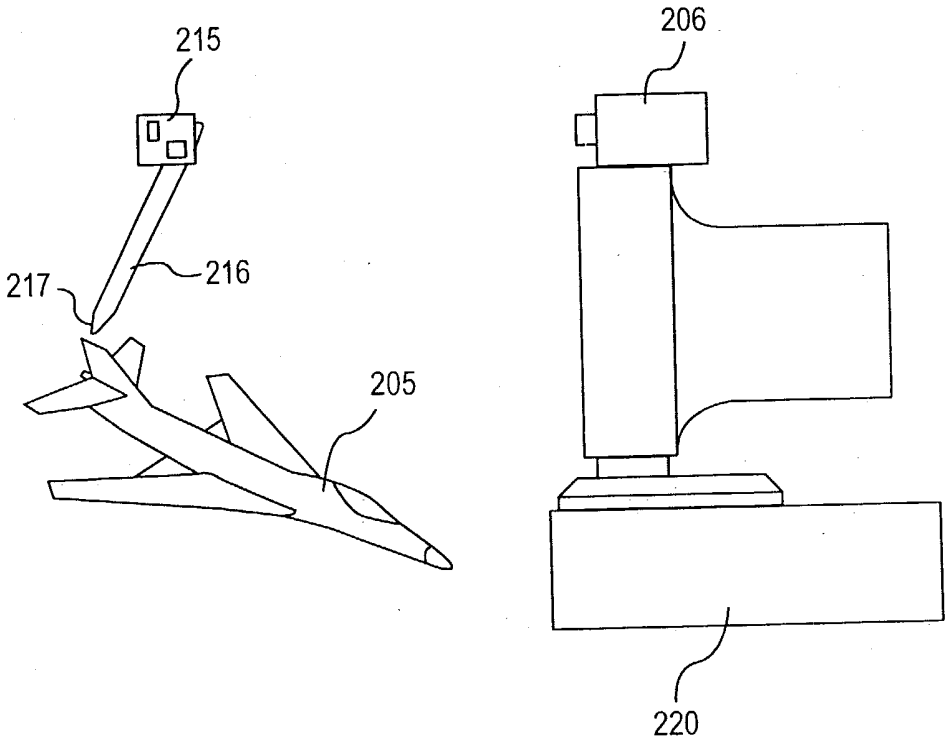

FIG. 2a

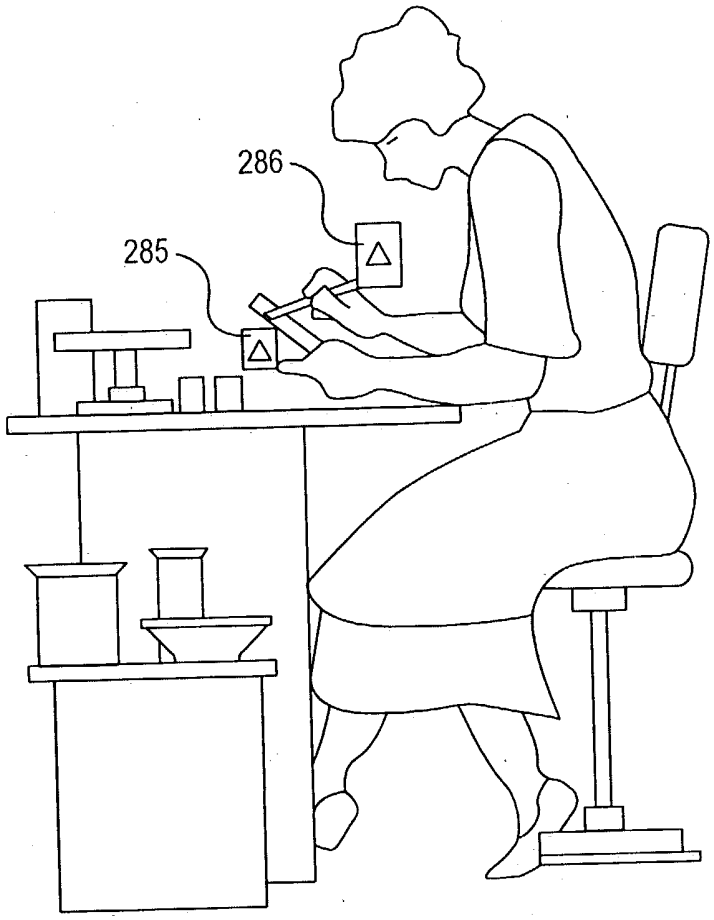

FIG. 2b

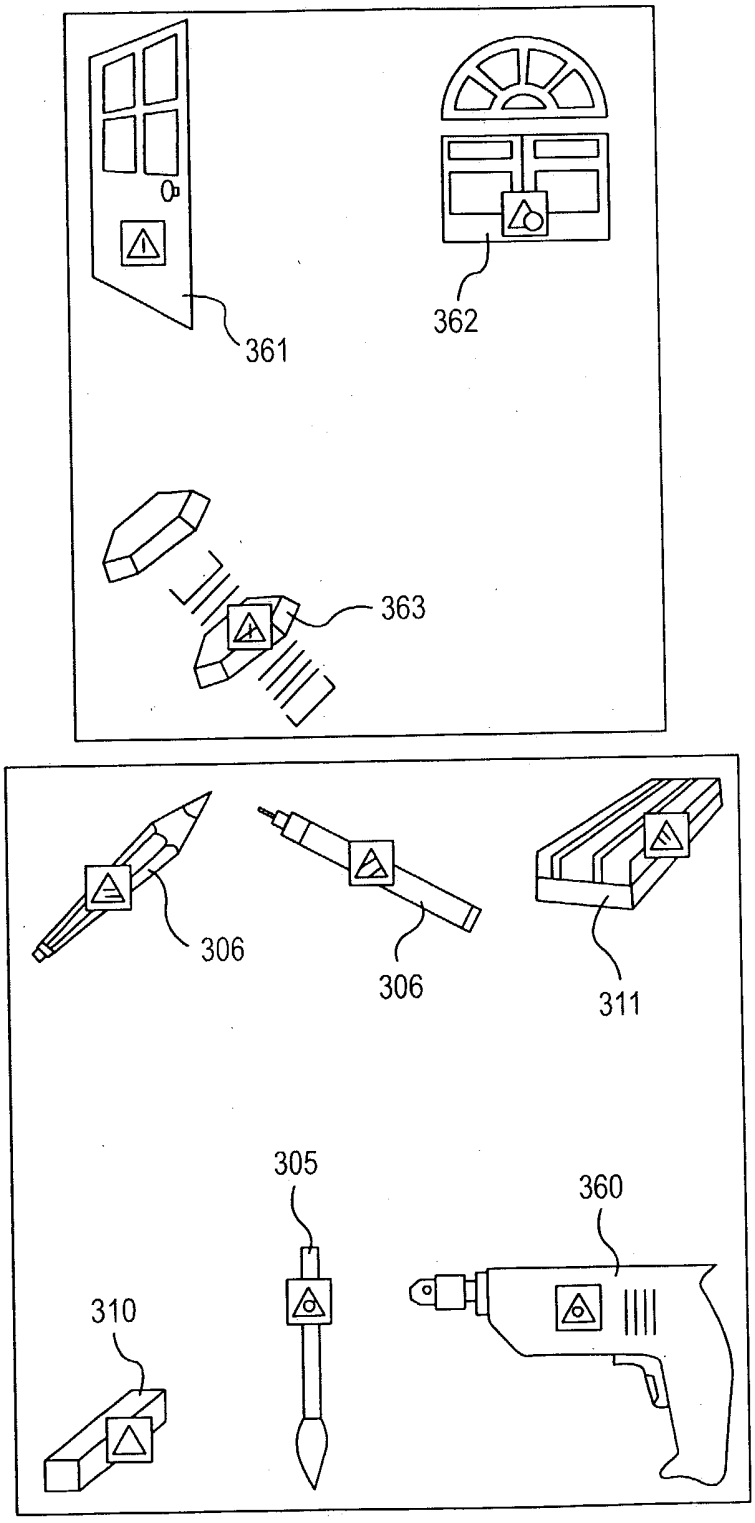

FIG. 3a

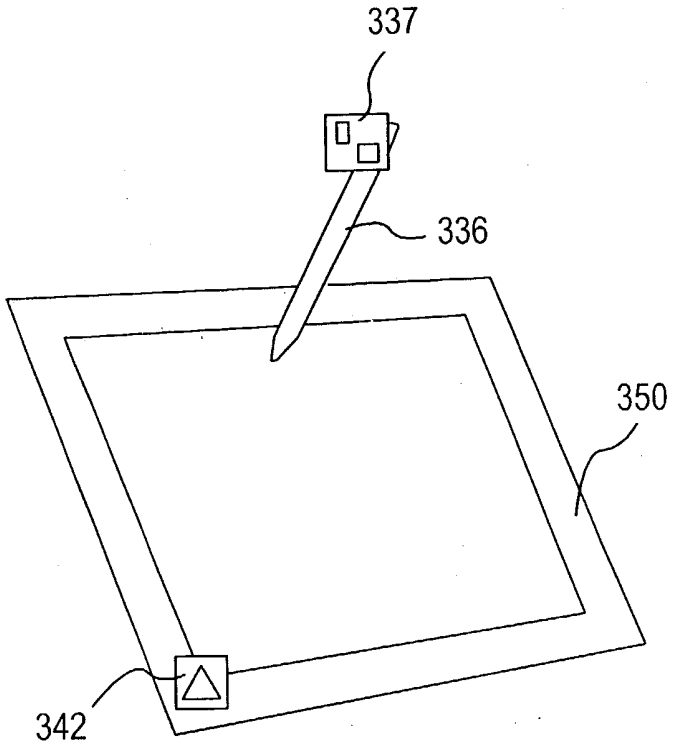

FIG. 3b

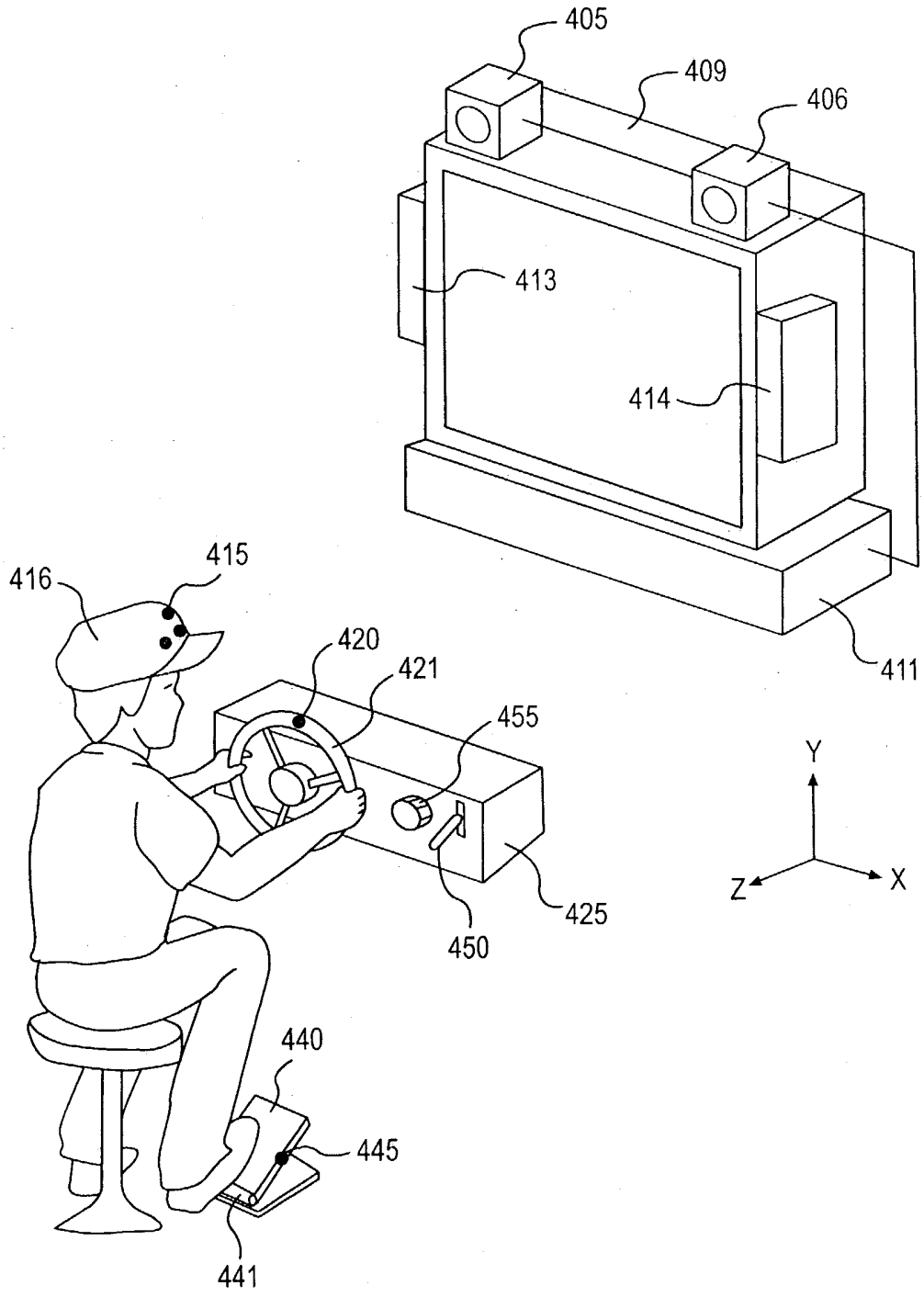
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FIG. 4

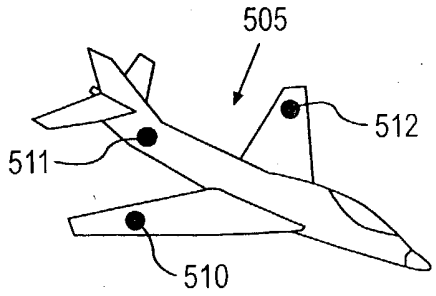


FIG. 5a

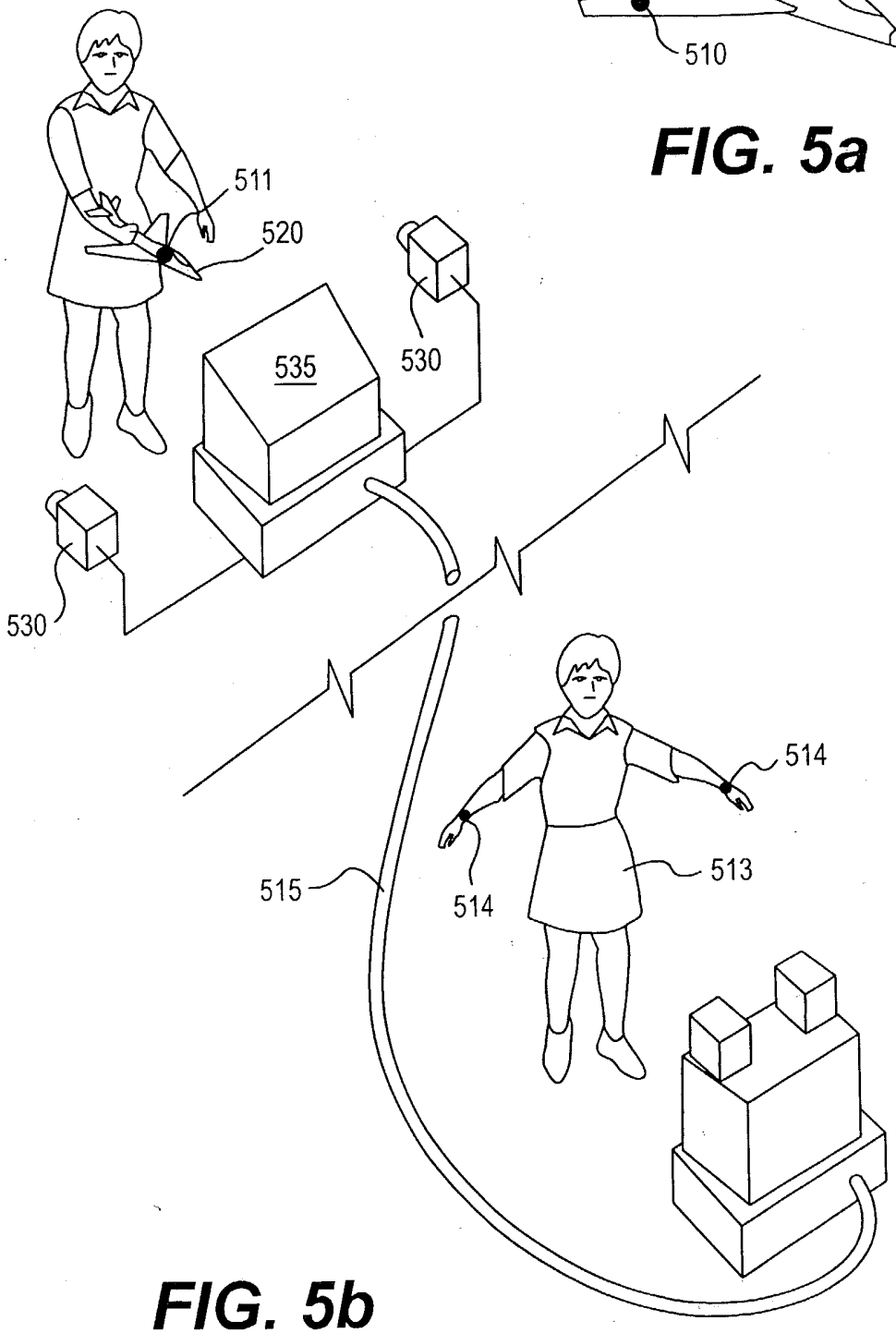
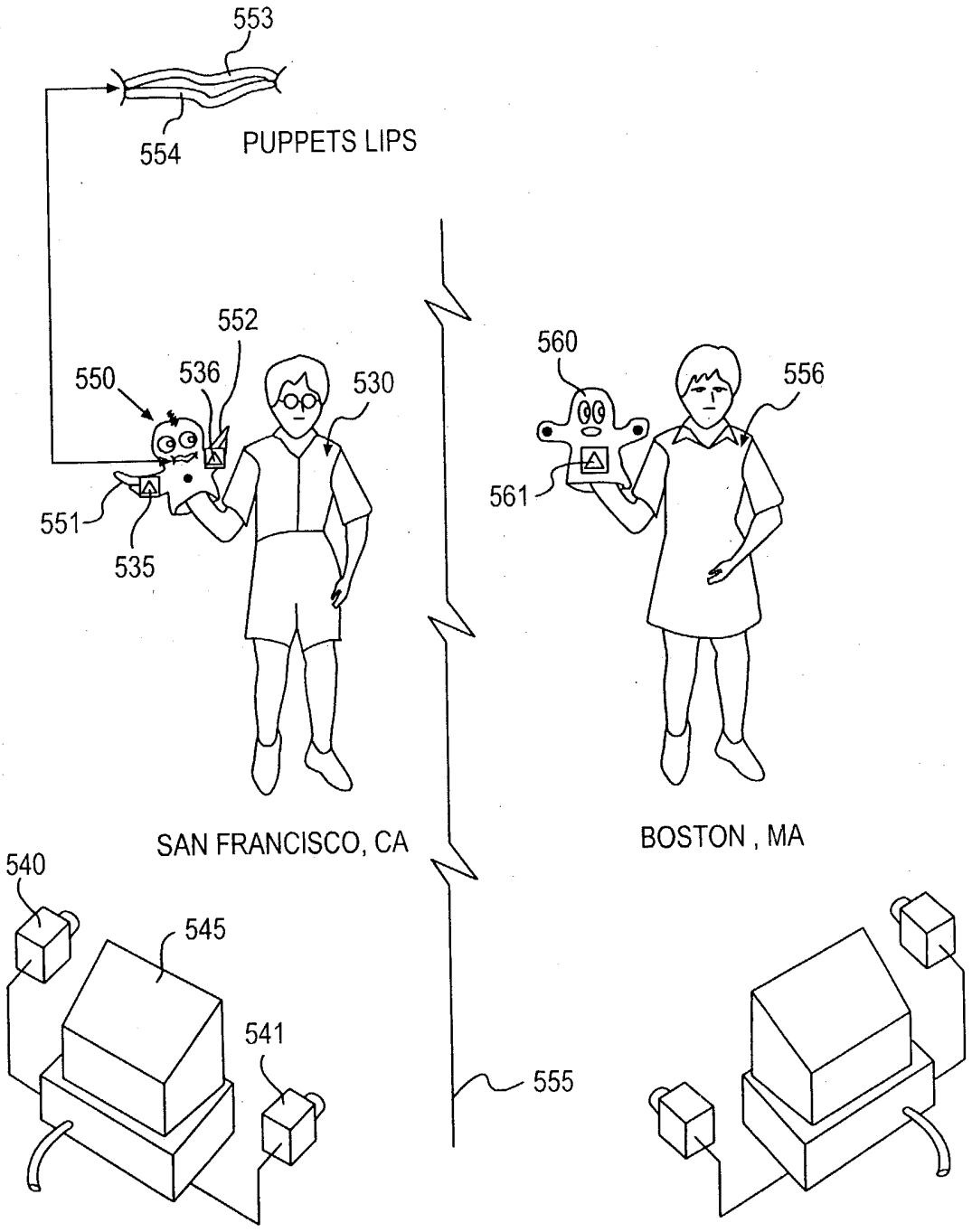


FIG. 5b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SAN FRANCISCO, CA
BOSTON , MA
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FIG. 5c

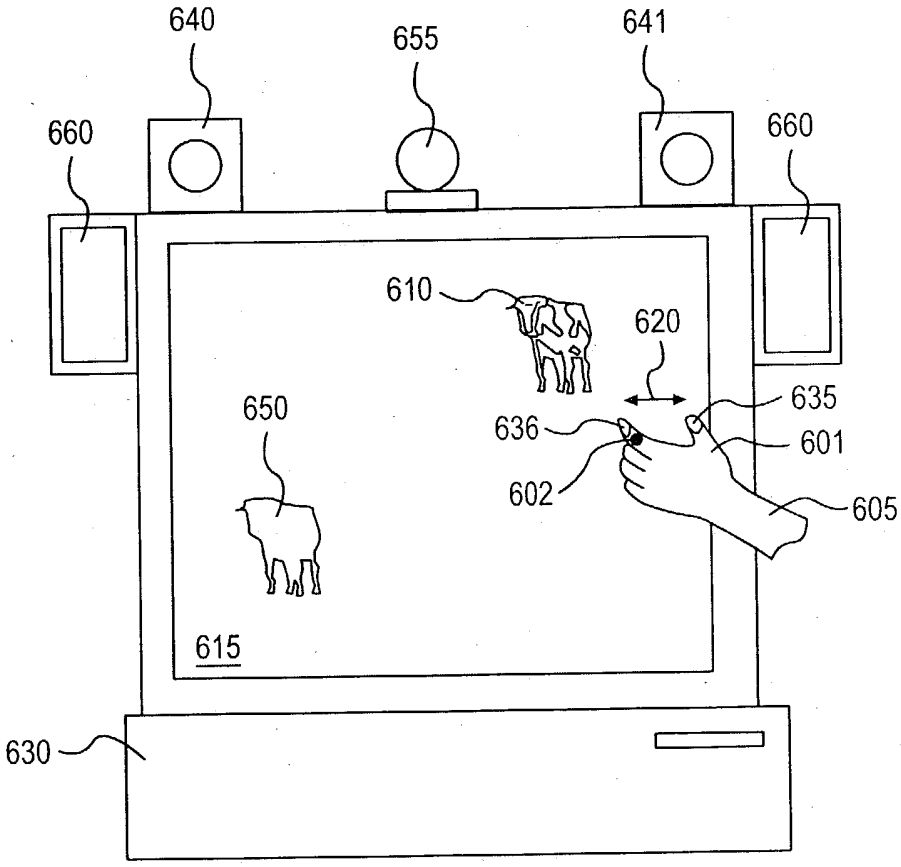

FIG. 6

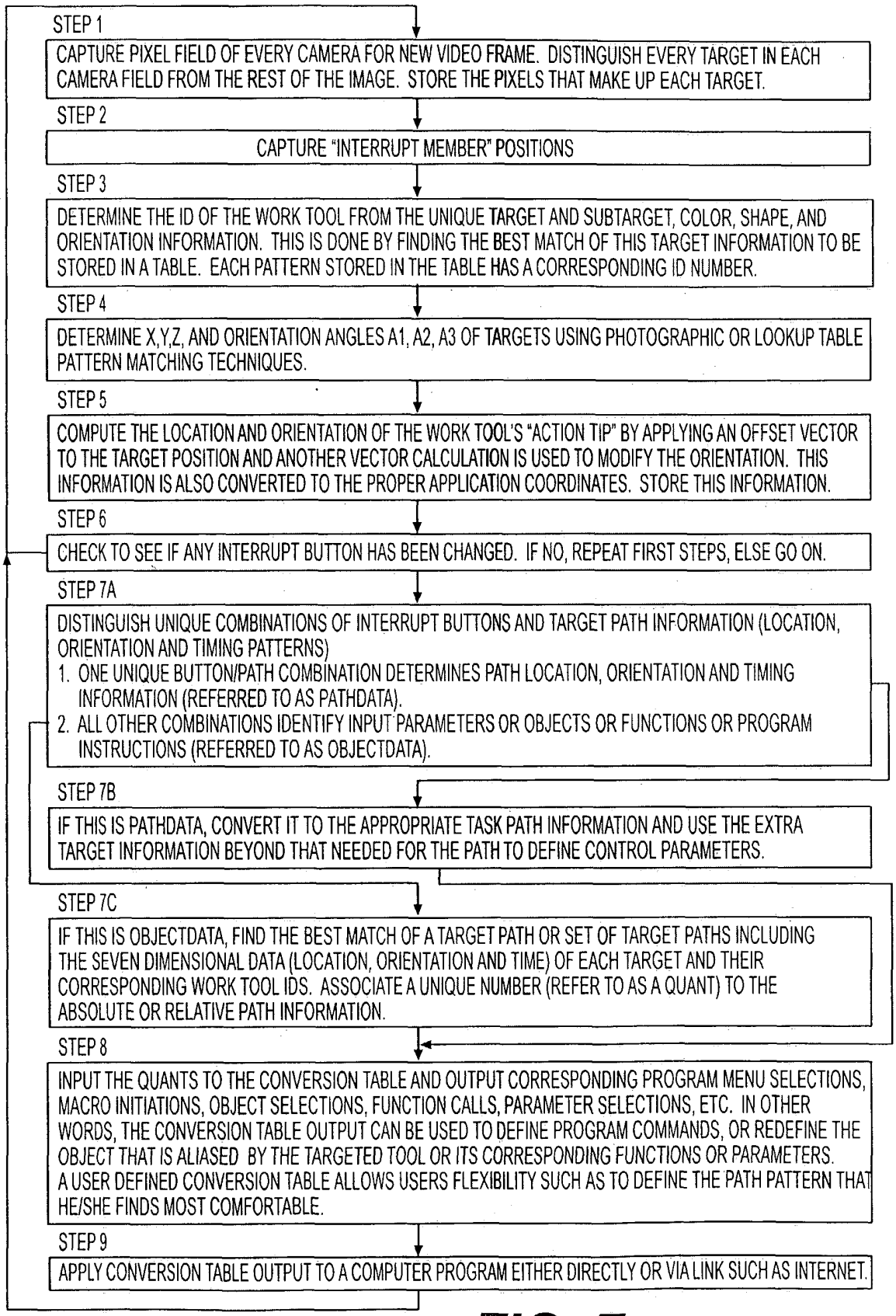
STEP 1
CAPTURE PIXEL FIELD OF EVERY CAMERA FOR NEW VIDEO FRAME. DISTINGUISH EVERY TARGET IN EACH CAMERA FIELD FROM THE REST OF THE IMAGE. STORE THE PIXELS THAT MAKE UP EACH TARGET.
STEP 2
CAPTURE "INTERRUPT MEMBER" POSITIONS
STEP 3
DETERMINE THE ID OF THE WORK TOOL FROM THE UNIQUE TARGET AND SUBTARGET, COLOR, SHAPE, AND ORIENTATION INFORMATION. THIS IS DONE BY FINDING THE BEST MATCH OF THIS TARGET INFORMATION TO BE STORED IN A TABLE. EACH PATTERN STORED IN THE TABLE HAS A CORRESPONDING ID NUMBER.
STEP 4
DETERMINE X,Y,Z, AND ORIENTATION ANGLES A1, A2, A3 OF TARGETS USING PHOTOGRAPHIC OR LOOKUP TABLE PATTERN MATCHING TECHNIQUES.
STEP 5
COMPUTE THE LOCATION AND ORIENTATION OF THE WORK TOOL'S "ACTION TIP" BY APPLYING AN OFFSET VECTOR TO THE TARGET POSITION AND ANOTHER VECTOR CALCULATION IS USED TO MODIFY THE ORIENTATION. THIS INFORMATION IS ALSO CONVERTED TO THE PROPER APPLICATION COORDINATES. STORE THIS INFORMATION.
STEP 6
CHECK TO SEE IF ANY INTERRUPT BUTTON HAS BEEN CHANGED. IF NO, REPEAT FIRST STEPS, ELSE GO ON.
STEP 7A
DISTINGUISH UNIQUE COMBINATIONS OF INTERRUPT BUTTONS AND TARGET PATH INFORMATION (LOCATION, ORIENTATION AND TIMING PATTERNS)
1. ONE UNIQUE BUTTON/PATH COMBINATION DETERMINES PATH LOCATION, ORIENTATION AND TIMING INFORMATION (REFERRED TO AS PATHDATA).
2. ALL OTHER COMBINATIONS IDENTIFY INPUT PARAMETERS OR OBJECTS OR FUNCTIONS OR PROGRAM INSTRUCTIONS (REFERRED TO AS OBJECTDATA).
STEP 7B
IF THIS IS PATHDATA, CONVERT IT TO THE APPROPRIATE TASK PATH INFORMATION AND USE THE EXTRA TARGET INFORMATION BEYOND THAT NEEDED FOR THE PATH TO DEFINE CONTROL PARAMETERS.
STEP 7C
IF THIS IS OBJECTDATA, FIND THE BEST MATCH OF A TARGET PATH OR SET OF TARGET PATHS INCLUDING THE SEVEN DIMENSIONAL DATA (LOCATION, ORIENTATION AND TIME) OF EACH TARGET AND THEIR CORRESPONDING WORK TOOL IDS. ASSOCIATE A UNIQUE NUMBER (REFER TO AS A QUANT) TO THE ABSOLUTE OR RELATIVE PATH INFORMATION.
STEP 8
INPUT THE QUANTS TO THE CONVERSION TABLE AND OUTPUT CORRESPONDING PROGRAM MENU SELECTIONS, MACRO INITIATIONS, OBJECT SELECTIONS, FUNCTION CALLS, PARAMETER SELECTIONS, ETC. IN OTHER WORDS, THE CONVERSION TABLE OUTPUT CAN BE USED TO DEFINE PROGRAM COMMANDS, OR REDEFINE THE OBJECT THAT IS ALIASED BY THE TARGETED TOOL OR ITS CORRESPONDING FUNCTIONS OR PARAMETERS. A USER DEFINED CONVERSION TABLE ALLOWS USERS FLEXIBILITY SUCH AS TO DEFINE THE PATH PATTERN THAT HE/SHE FINDS MOST COMFORTABLE.
STEP 9
APPLY CONVERSION TABLE OUTPUT TO A COMPUTER PROGRAM EITHER DIRECTLY OR VIA LINK SUCH AS INTERNET.

FIG. 7

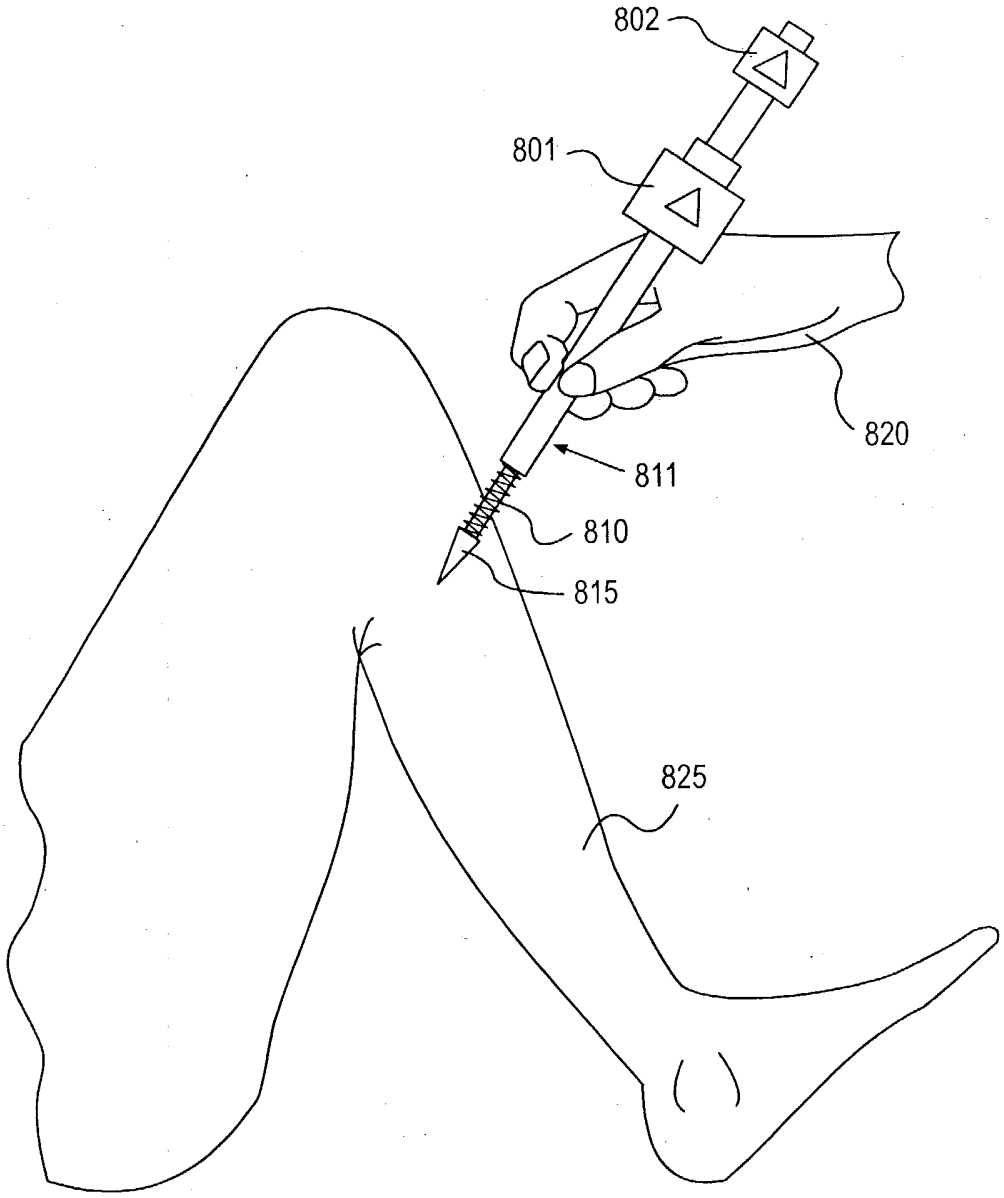

FIG. 8a

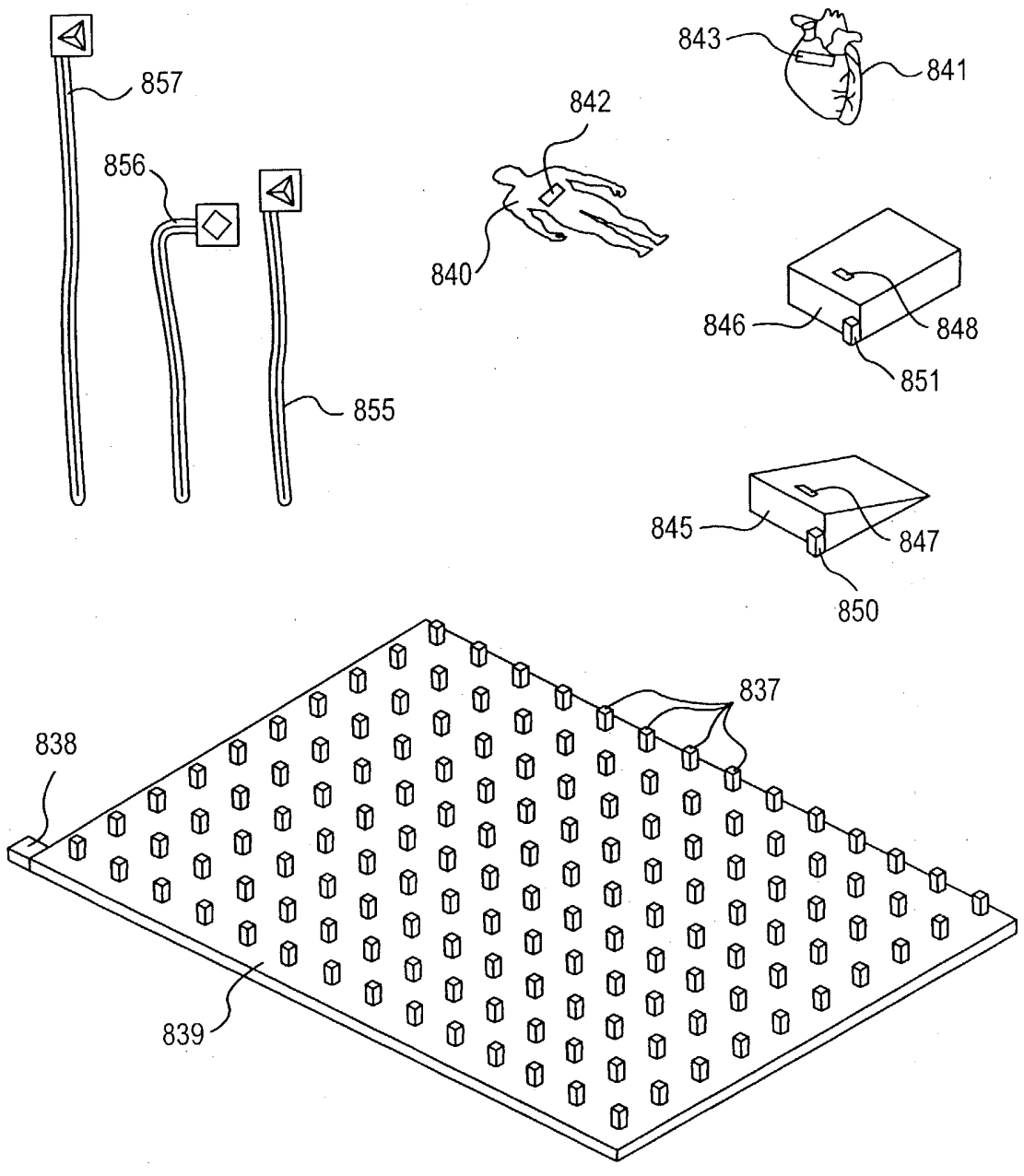

FIG. 8b

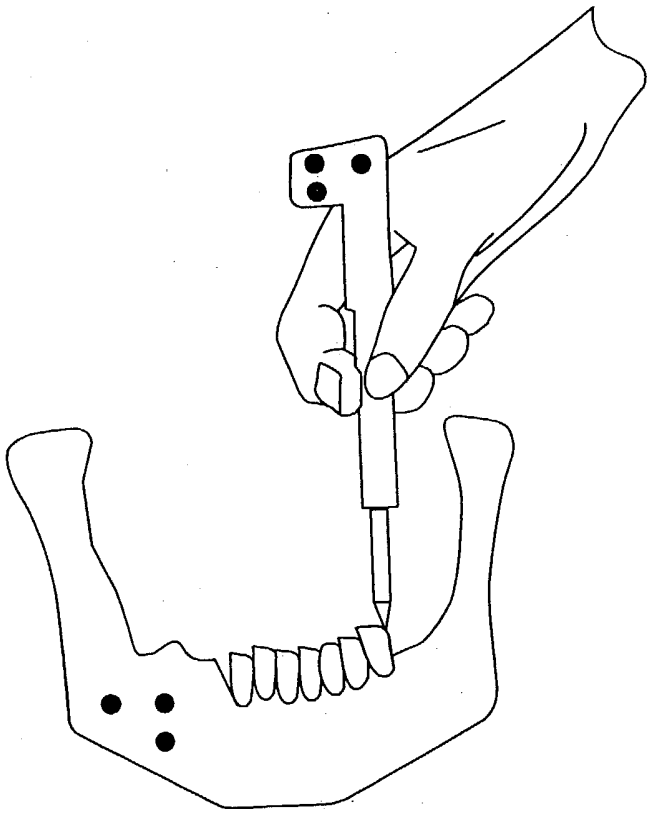

FIG. 8c

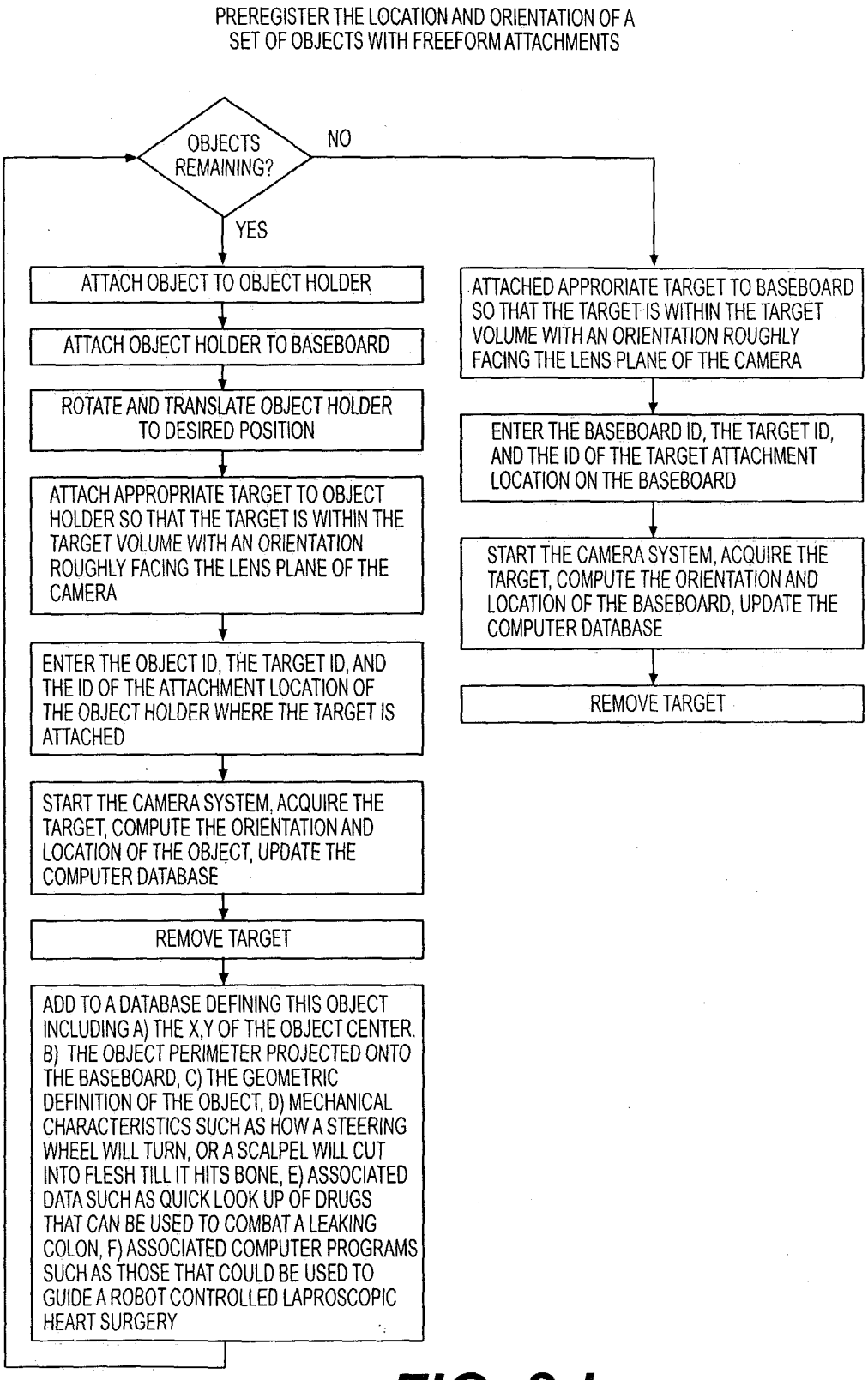
PREREGISTER THE LOCATION AND ORIENTATION OF A SET OF OBJECTS WITH FREEFORM ATTACHMENTS
OBJECTS REMAINING?
NO
YES
ATTACH OBJECT TO OBJECT HOLDER
ATTACH OBJECT HOLDER TO BASEBOARD
ROTATE AND TRANSLATE OBJECT HOLDER TO DESIRED POSITION
ATTACH APPROPRIATE TARGET TO OBJECT HOLDER SO THAT THE TARGET IS WITHIN THE TARGET VOLUME WITH AN ORIENTATION ROUGHLY FACING THE LENS PLANE OF THE CAMERA
ENTER THE OBJECT ID, THE TARGET ID, AND THE ID OF THE ATTACHMENT LOCATION OF THE OBJECT HOLDER WHERE THE TARGET IS ATTACHED
START THE CAMERA SYSTEM, ACQUIRE THE TARGET, COMPUTE THE ORIENTATION AND LOCATION OF THE OBJECT, UPDATE THE COMPUTER DATABASE
REMOVE TARGET
ADD TO A DATABASE DEFINING THIS OBJECT INCLUDING A) THE X,Y OF THE OBJECT CENTER. B) THE OBJECT PERIMETER PROJECTED ONTO THE BASEBOARD, C) THE GEOMETRIC DEFINITION OF THE OBJECT, D) MECHANICAL CHARACTERISTICS SUCH AS HOW A STEERING WHEEL WILL TURN, OR A SCALPEL WILL CUT INTO FLESH TILL IT HITS BONE, E) ASSOCIATED DATA SUCH AS QUICK LOOK UP OF DRUGS THAT CAN BE USED TO COMBAT A LEAKING COLON, F) ASSOCIATED COMPUTER PROGRAMS SUCH AS THOSE THAT COULD BE USED TO GUIDE A ROBOT CONTROLLED LAPROSCOPIC HEART SURGERY
ATTACHED APPRORIATE TARGET TO BASEBOARD SO THAT THE TARGET IS WITHIN THE TARGET VOLUME WITH AN ORIENTATION ROUGHLY FACING THE LENS PLANE OF THE CAMERA
ENTER THE BASEBOARD ID, THE TARGET ID, AND THE ID OF THE TARGET ATTACHMENT LOCATION ON THE BASEBOARD
START THE CAMERA SYSTEM, ACQUIRE THE TARGET, COMPUTE THE ORIENTATION AND LOCATION OF THE BASEBOARD, UPDATE THE COMPUTER DATABASE
REMOVE TARGET

FIG. 8d

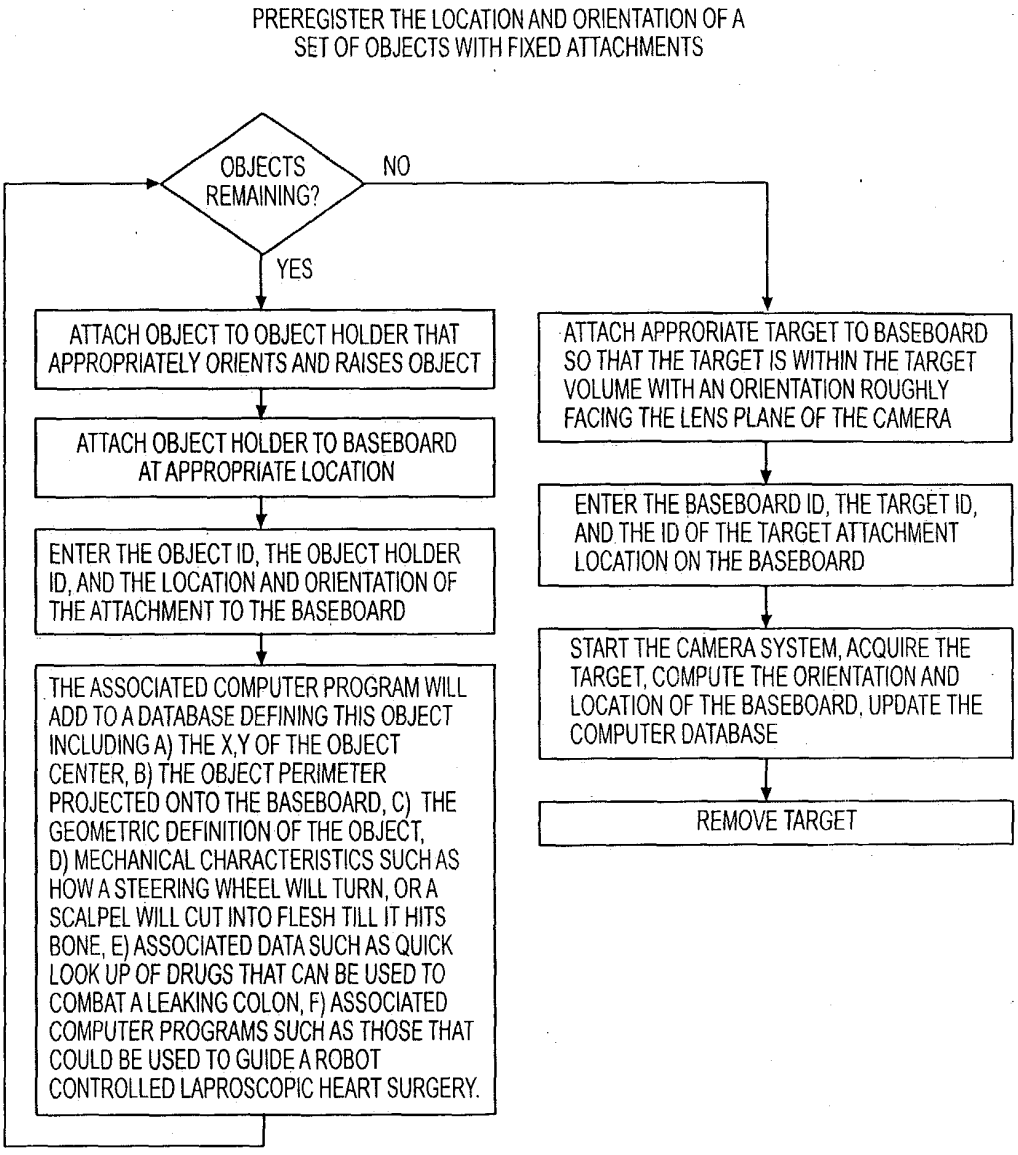
PREREGISTER THE LOCATION AND ORIENTATION OF A SET OF OBJECTS WITH FIXED ATTACHMENTS
OBJECTS REMAINING?
NO
YES
ATTACH OBJECT TO OBJECT HOLDER THAT APPROPRIATELY ORIENTS AND RAISES OBJECT
ATTACH OBJECT HOLDER TO BASEBOARD AT APPROPRIATE LOCATION
ENTER THE OBJECT ID, THE OBJECT HOLDER ID, AND THE LOCATION AND ORIENTATION OF THE ATTACHMENT TO THE BASEBOARD
THE ASSOCIATED COMPUTER PROGRAM WILL ADD TO A DATABASE DEFINING THIS OBJECT INCLUDING A) THE X,Y OF THE OBJECT CENTER, B) THE OBJECT PERIMETER PROJECTED ONTO THE BASEBOARD, C) THE GEOMETRIC DEFINITION OF THE OBJECT, D) MECHANICAL CHARACTERISTICS SUCH AS HOW A STEERING WHEEL WILL TURN, OR A SCALPEL WILL CUT INTO FLESH TILL IT HITS BONE, E) ASSOCIATED DATA SUCH AS QUICK LOOK UP OF DRUGS THAT CAN BE USED TO COMBAT A LEAKING COLON, F) ASSOCIATED COMPUTER PROGRAMS SUCH AS THOSE THAT COULD BE USED TO GUIDE A ROBOT CONTROLLED LAPROSCOPIC HEART SURGERY.
ATTACH APPRORIATE TARGET TO BASEBOARD SO THAT THE TARGET IS WITHIN THE TARGET VOLUME WITH AN ORIENTATION ROUGHLY FACING THE LENS PLANE OF THE CAMERA
ENTER THE BASEBOARD ID, THE TARGET ID, AND THE ID OF THE TARGET ATTACHMENT LOCATION ON THE BASEBOARD
START THE CAMERA SYSTEM, ACQUIRE THE TARGET, COMPUTE THE ORIENTATION AND LOCATION OF THE BASEBOARD, UPDATE THE COMPUTER DATABASE
REMOVE TARGET

FIG. 8e

UTILIZING TARGETED POINTERS WITH A SET OF PREREGISTERED OBJECTS

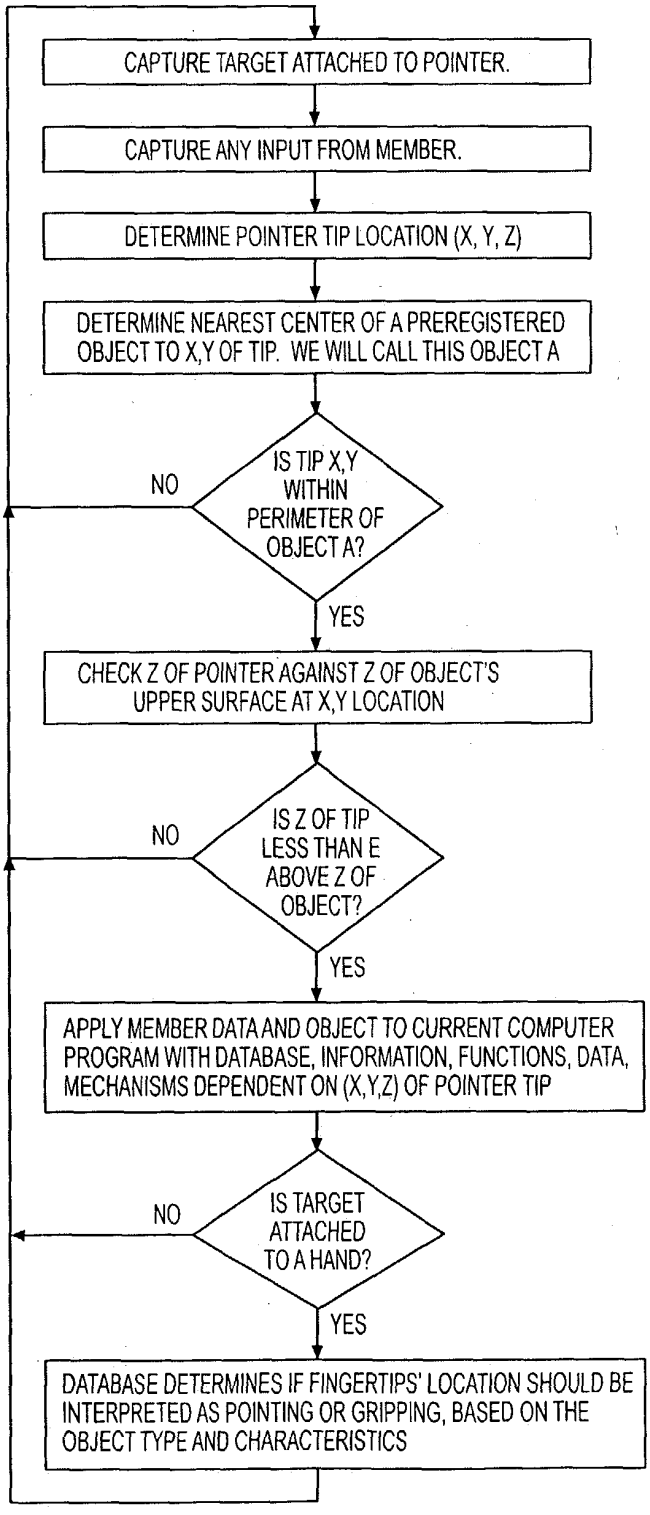

FIG. 8f

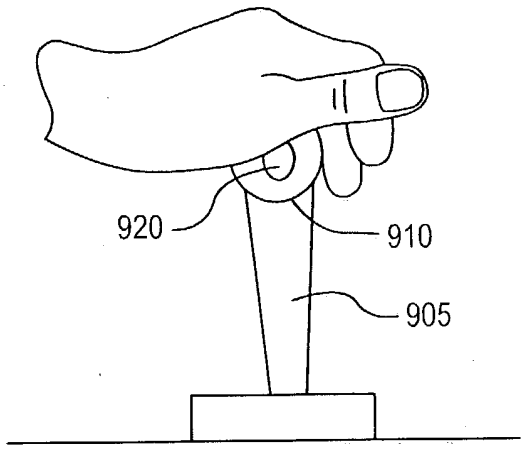

FIG. 9a

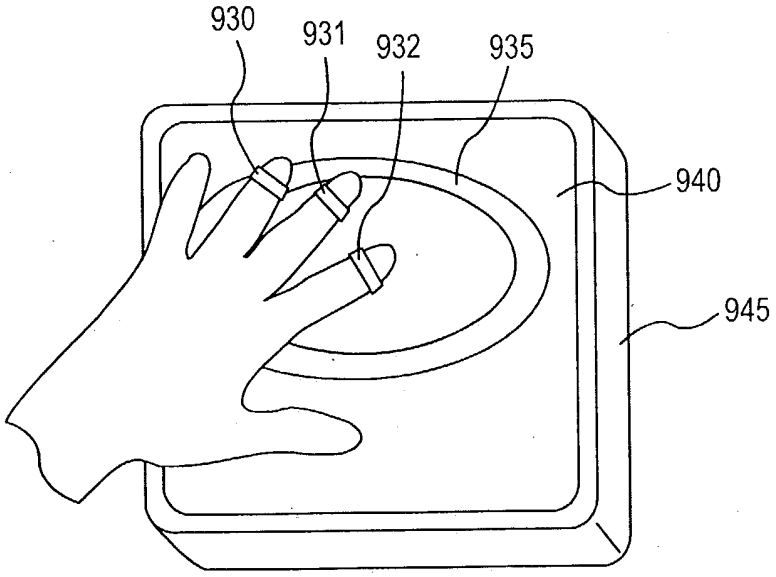

FIG. 9b

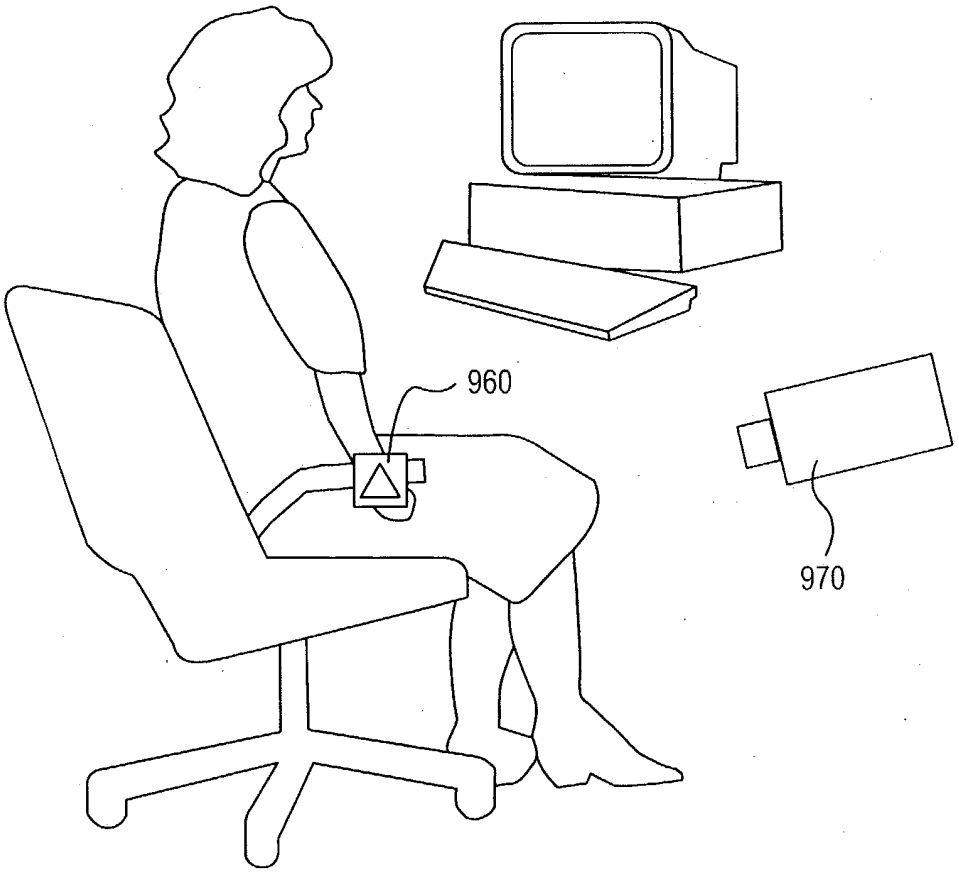

FIG. 9c

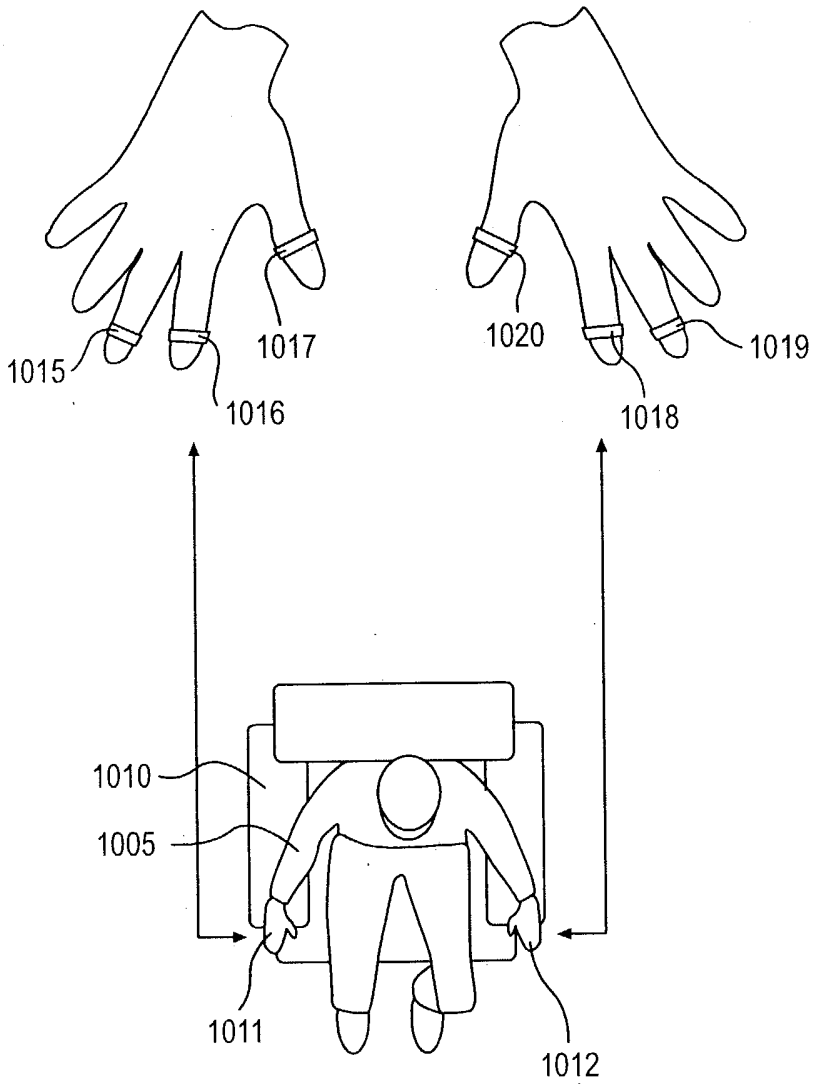

FIG. 10

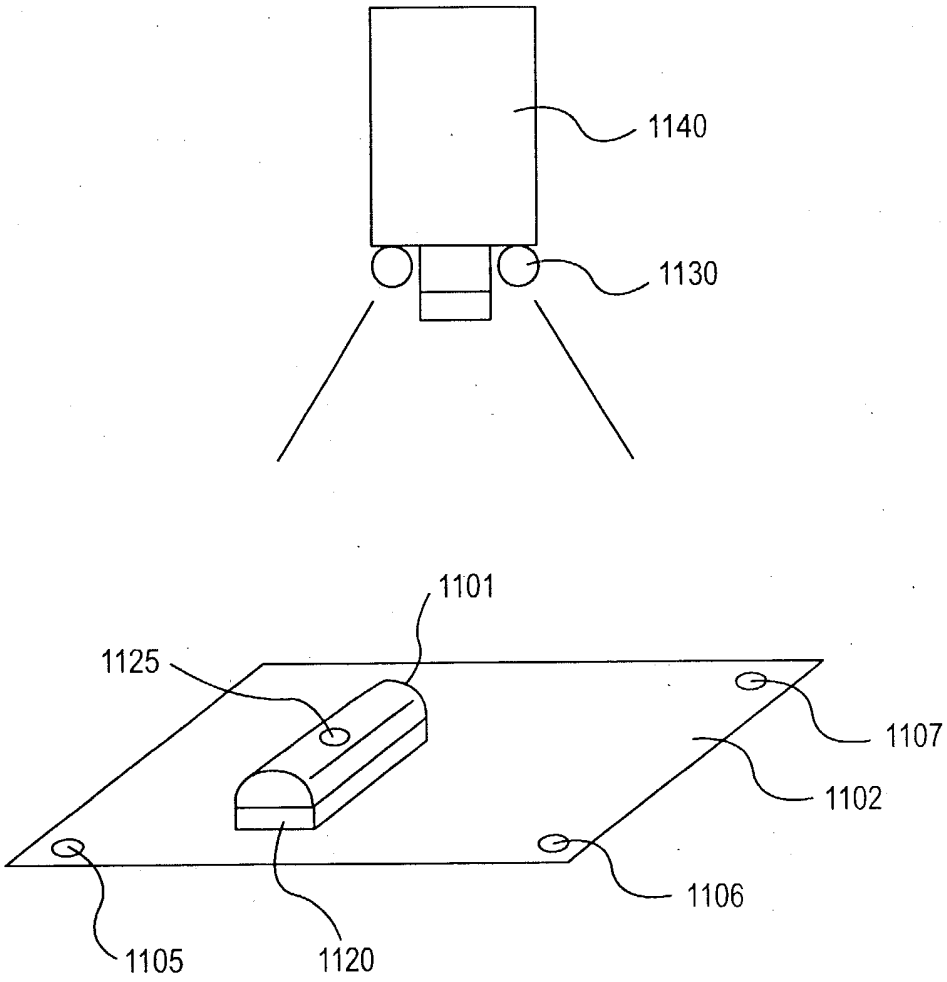

FIG. 11

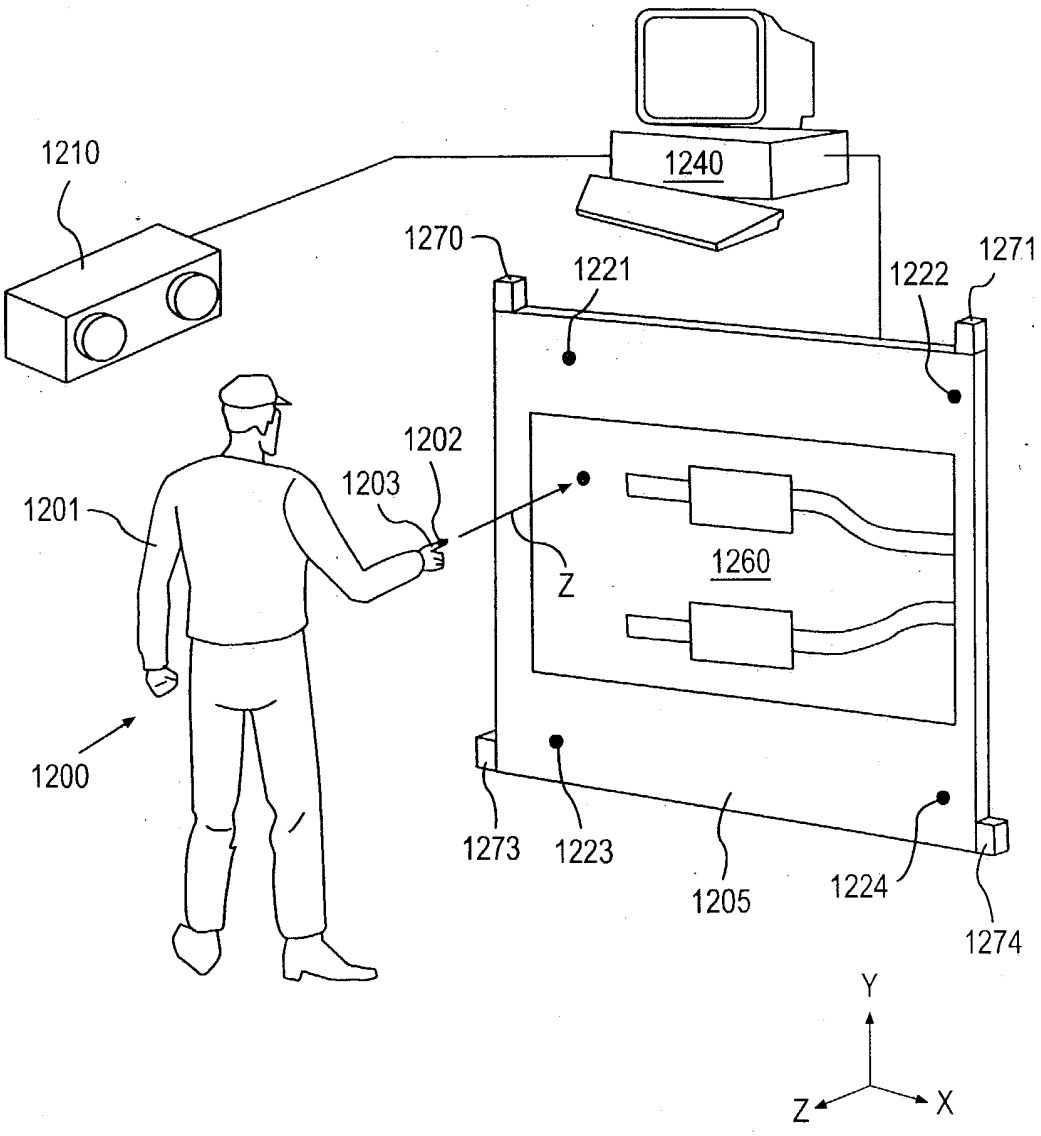
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FIG. 12

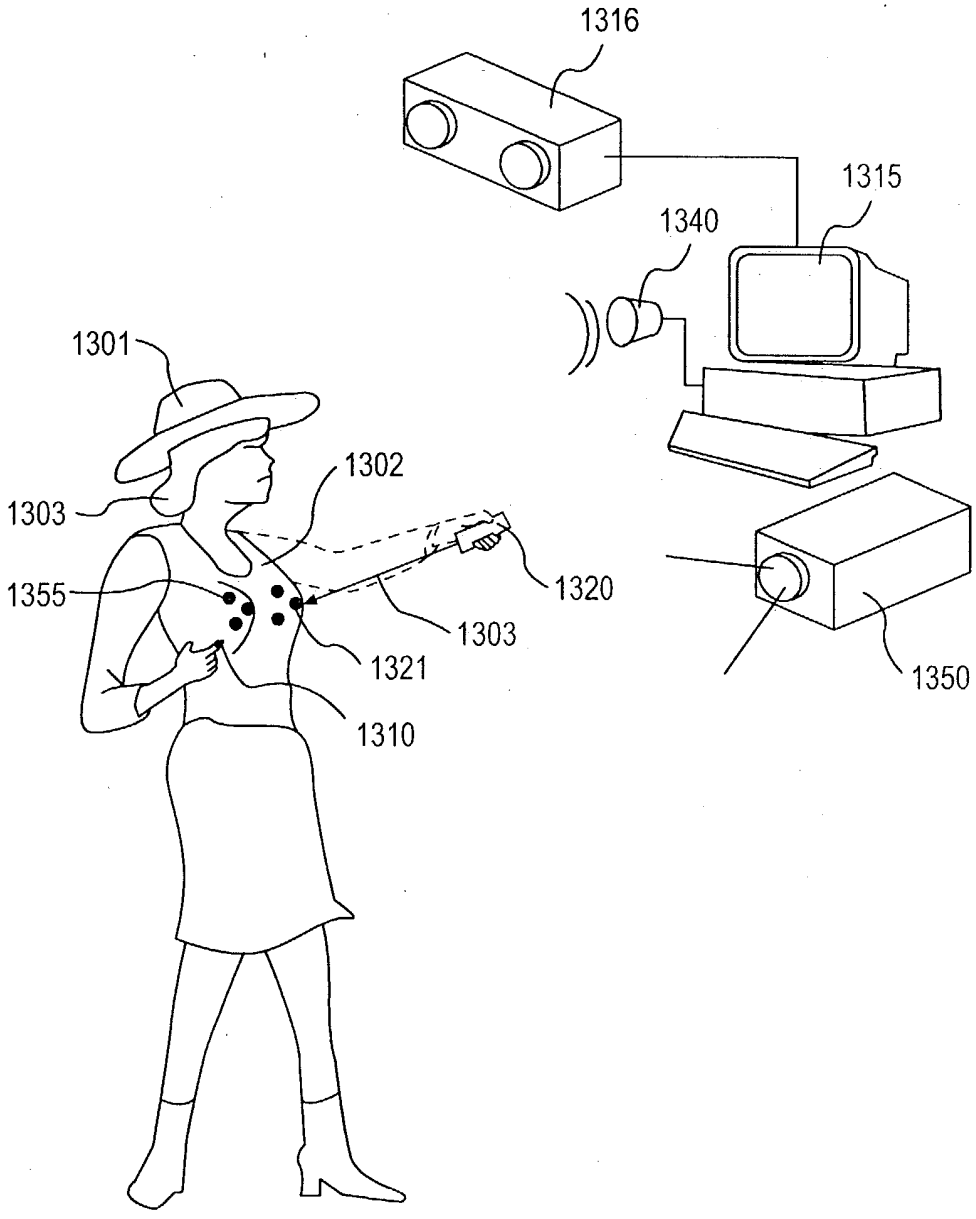

FIG. 13

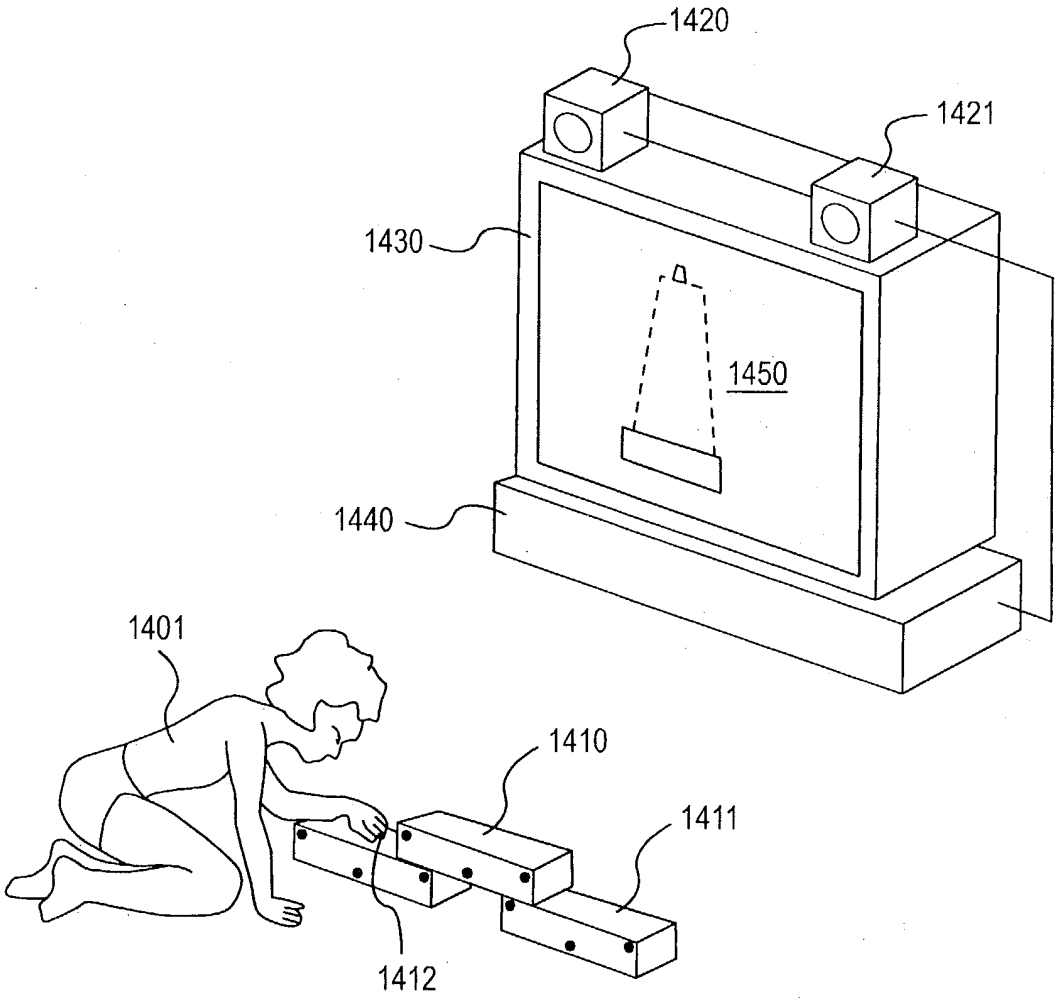

FIG. 14

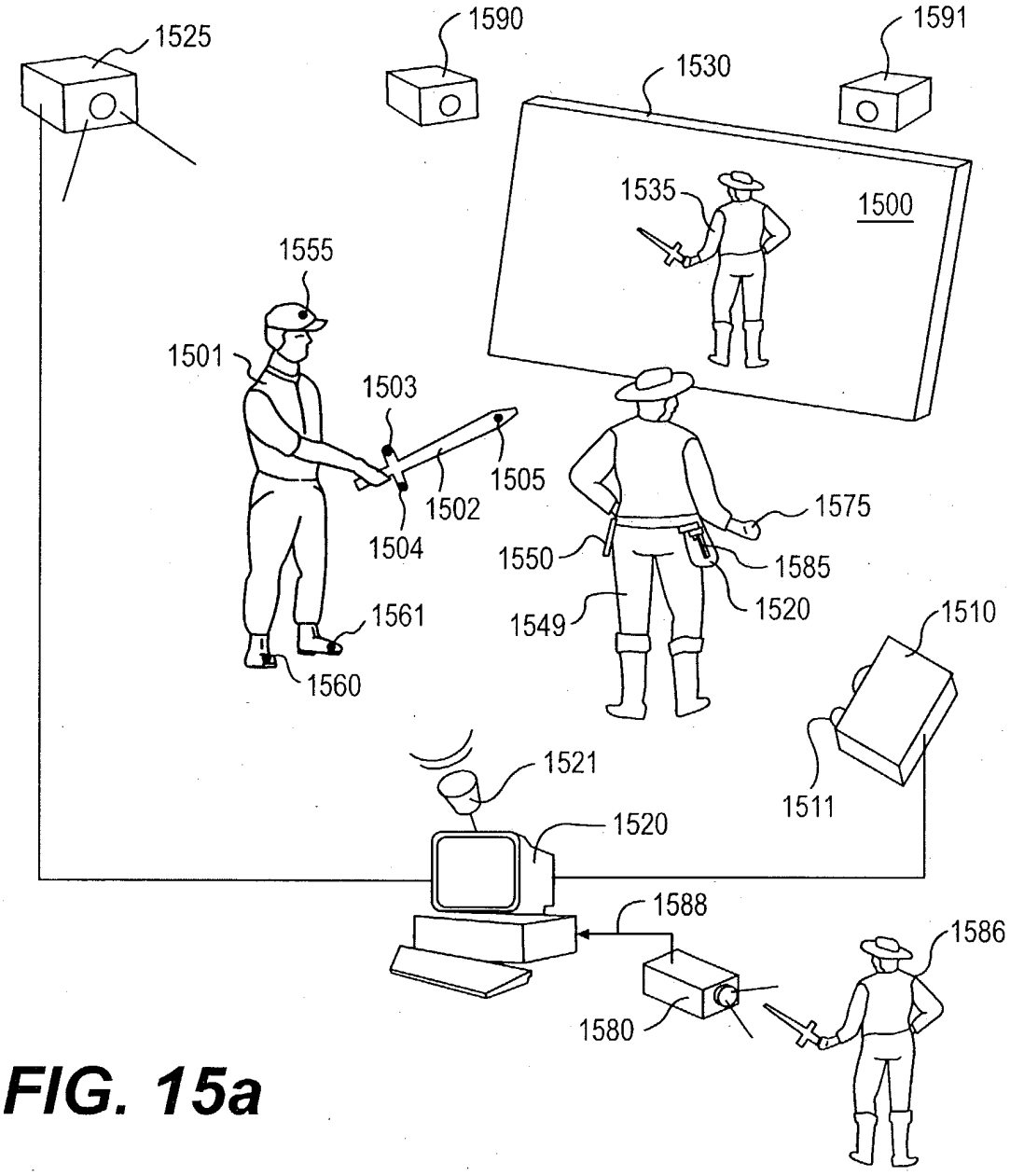

FIG. 15a

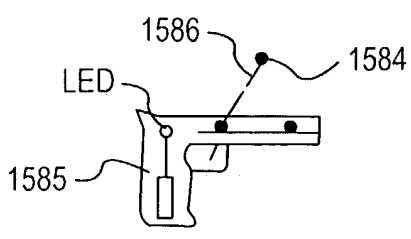

FIG. 15b

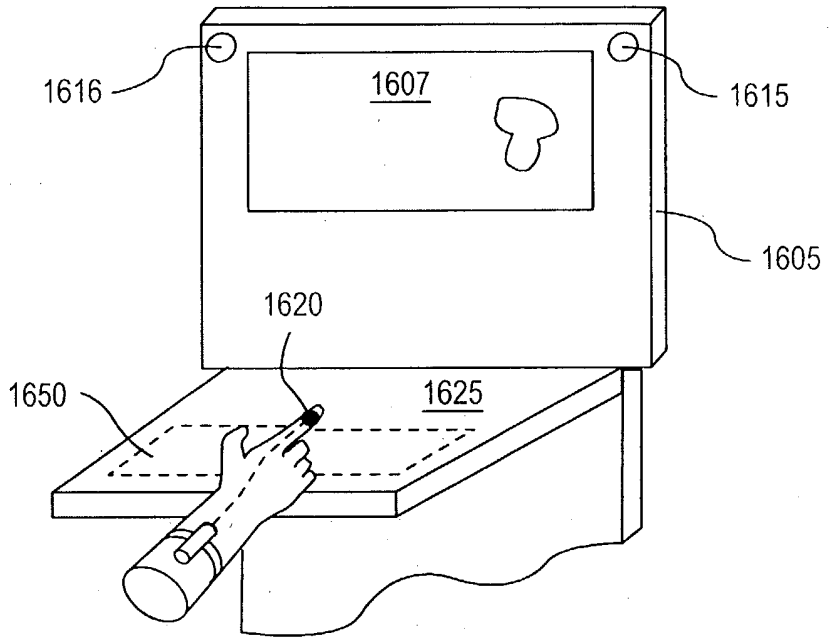
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FIG. 16

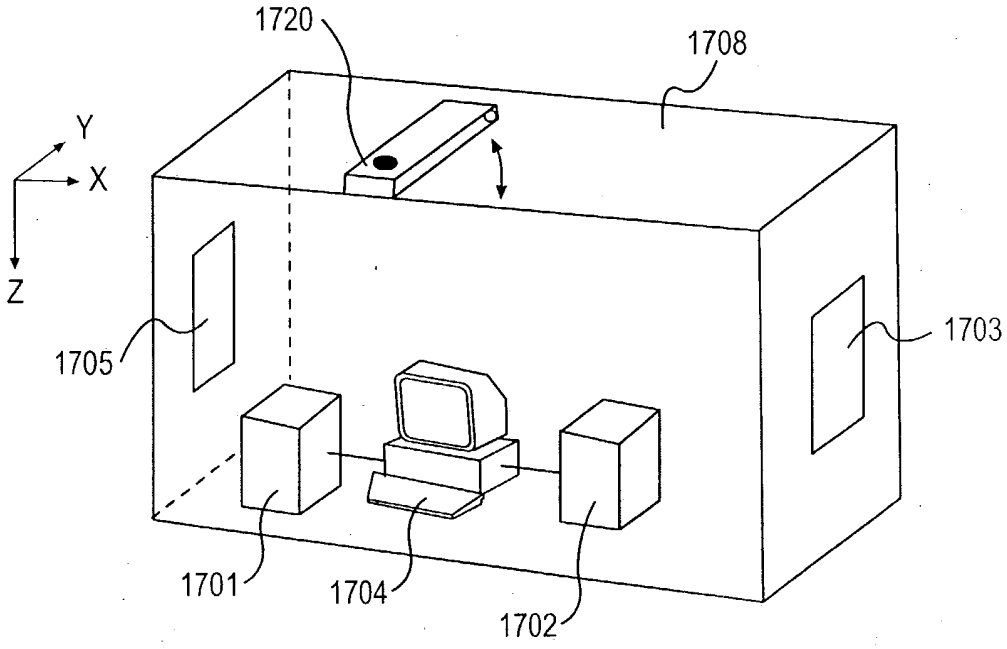
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FIG. 17

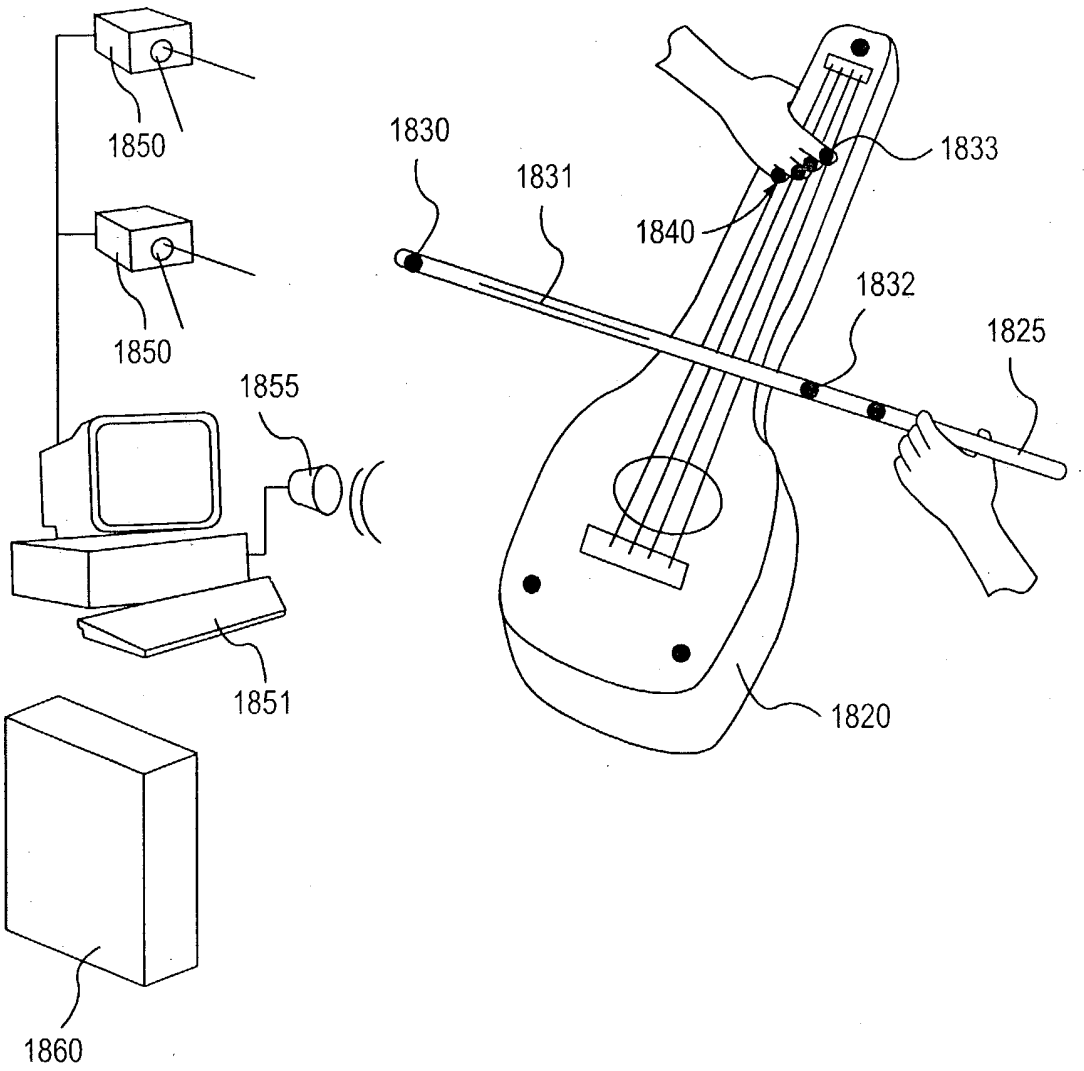

FIG. 18

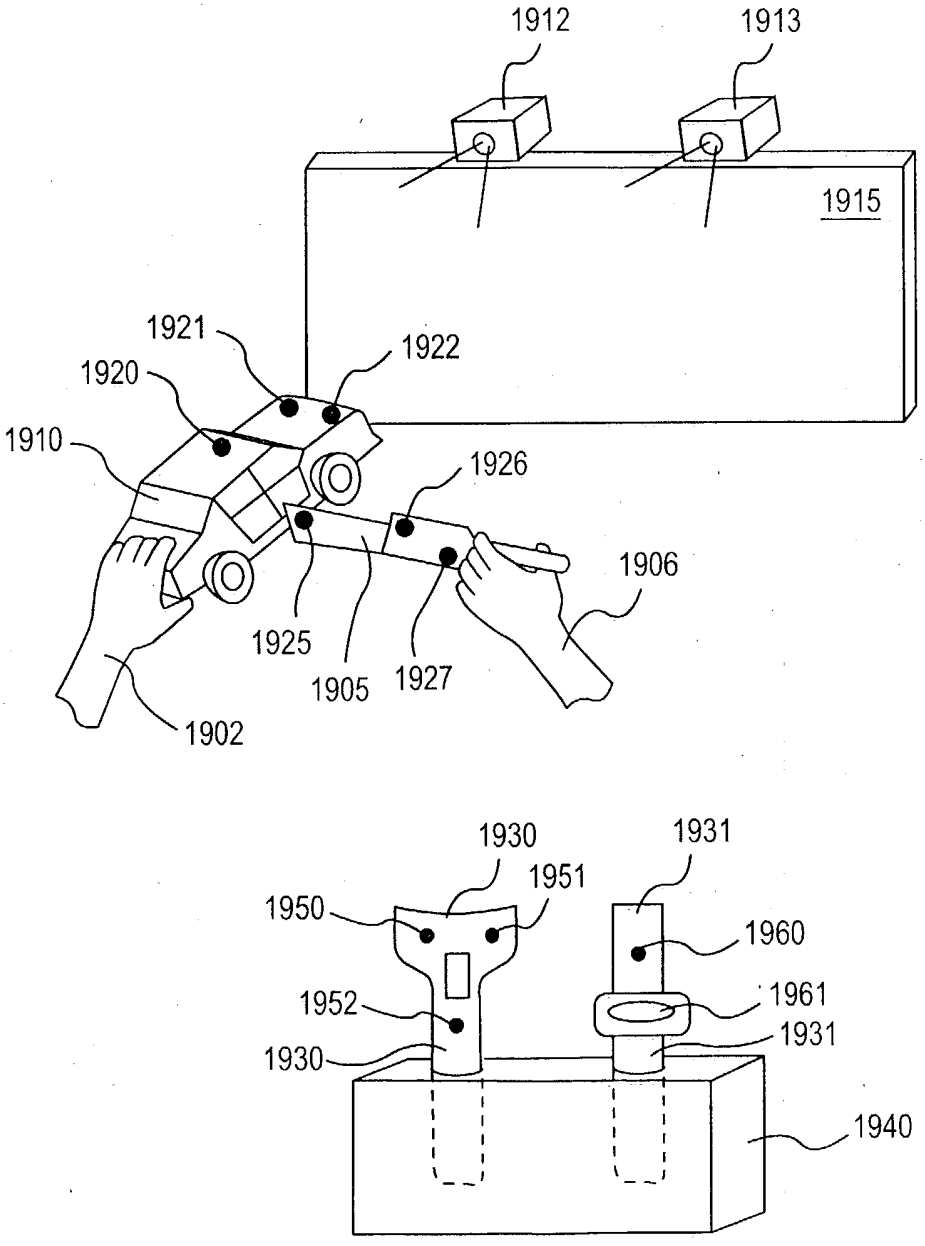
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FIG. 19

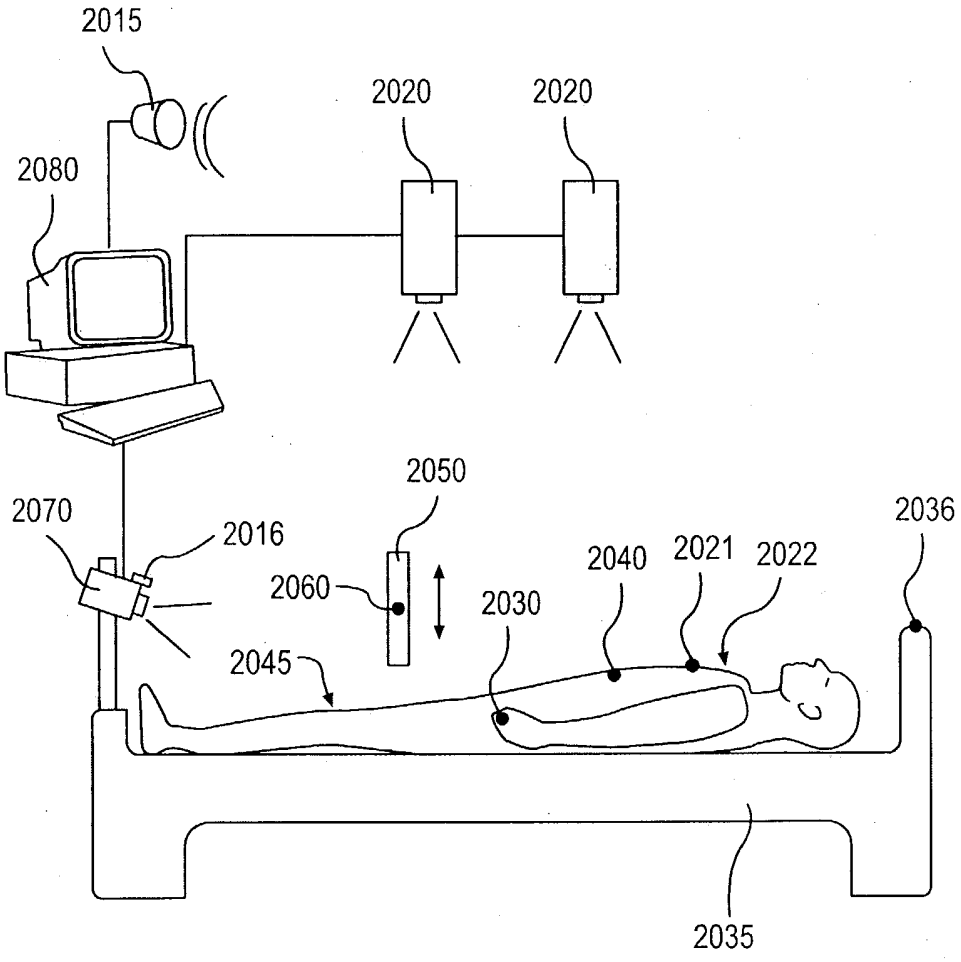
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FIG. 20

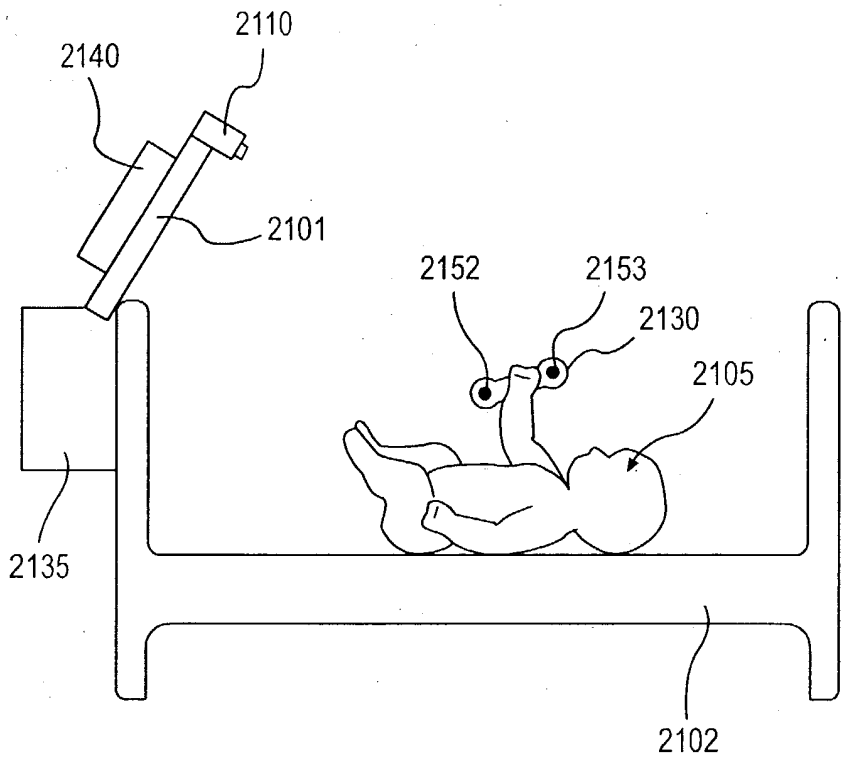

FIG. 21